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# Online Yoga for Students Experiencing Distress: A Single Case Experimental Design into the Psychological Mechanisms of Change

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Keywords: Yoga, students, mechanism of change, self-help, psychological distress.

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## Portfolio Abstract


### Background

Mental health difficulties among university students have risen sharply, particularly since the COVID-19 pandemic, and are linked to impairments in academic performance, quality of life, and overall health. University counselling services often struggle to meet demand, with many students reporting barriers to timely support. This highlights the need for accessible self-help interventions.

Yoga, a mind–body practice incorporating physical postures, breathing, and meditation, has been shown to reduce psychological distress and enhance wellbeing in both clinical and non-clinical populations. Online delivery is feasible and acceptable, making yoga a potentially valuable intervention. However, the mechanisms of change (MOC) that underpin its benefits remain poorly understood, which limits its clinical application. Psychological flexibility and self-compassion are two processes theorised to contribute to improved mental health.

As part of this thesis, a systematic review was conducted to evaluate the effectiveness of yoga in alleviating stress and distress among people with mental health difficulties. Across nine randomised controlled trials, yoga demonstrated consistent benefits for psychological distress, although the evidence for psychological stress was mixed.

### Methods

A six-week online pre-recorded yoga intervention was delivered using a multiple single-case experimental design (SCED) with non-concurrent baselines and an A–B–A withdrawal format. Thirty students were recruited, with fourteen completing the study. Participants were over 18, experiencing mild-to-moderate distress, and not engaged in regular yoga practice.

The intervention consisted of daily 30-minute pre-recorded Hatha yoga sessions. Quantitative measures assessed psychological flexibility, self-compassion, distress, and wellbeing. Weekly diaries and post-intervention Client Change Interviews (CCI) explored engagement and perceived change. Data were analysed using visual inspection, Fisher’s Dual Criteria (DC),

Percentage of data points Exceeding the Median (PEM), and Reliable and Clinically Significant Change indices (RCI/CSC).

**Results**

Findings showed a mixed pattern of effects. Mental wellbeing improved most consistently, with four participants demonstrating reliable and clinically significant gains at the post-intervention phase, and nine showing overall improvement across the study phases. Psychological distress showed little improvement and, for some, deterioration. Psychological flexibility outcomes varied, while self-compassion remained stable for most but declined in four participants.

Qualitative findings offered a more positive account: participants reported reduced stress and anxiety, improved sleep and physical flexibility. However, three reported pain or discomfort, highlighting some adverse effects of practicing yoga. The sample was predominantly male and racially diverse, providing a distinctive contribution to a field often dominated by homogenous populations.

**Conclusion**

This study challenges existing findings that suggest universally benefits of yoga on mental health. While consistent improvements in distress and proposed mechanisms were not observed, most participants reported gains in wellbeing, suggesting yoga's effects are highly individualised and context dependent. The feasibility and acceptability of online delivery were demonstrated, particularly among groups underrepresented in yoga research. Future research should examine culturally sensitive adaptations, longer interventions, and alternative mechanisms of change to clarify yoga's role in supporting student mental health.

## Statement of Contribution

Journal article and extended paper:

- Project design: Natasha Bloor, Dr Hannah Merdian, Dr David Dawson and Dr Sharron Smith
- Intervention design: Natasha Bloor, Julie Robinson (Yoga teacher), Dr Sharron Smith and Dr Hannah Merdian
- Applying for ethical approval: Natasha Bloor
- Recruiting participants: Natasha Bloor
- Scoring questionnaires: Natasha Bloor
- Entering data: Natasha Bloor
- Data analysis: Natasha Bloor (Supervised by Dr David Dawson and Dr Hannah Merdian)
- Write-up: Natasha Bloor (Supervised by Dr Hannah Merdian, Dr David Dawson and Dr Sharron Smith)

## Journal Paper

Paper prepared for submission to the International Journal of Wellbeing, see Appendix A for publication guidelines.

## Journal Abstract

**Background and purpose**: The prevalence of mental health difficulties among university students has risen sharply in recent years, creating significant demand for accessible and effective interventions. Research suggests that yoga is an effective intervention for reducing distress and enhancing wellbeing; however, the limited understanding of the mechanisms of change (MOC) in yoga limits its utility. This study investigated whether psychological flexibility and self-compassion function as MOC in yoga that contribute to improvements in psychological distress and mental wellbeing.

**Methods:** A six-week online yoga intervention was implemented using a multiple single case experimental design (SCED) with non-concurrent baselines and a mixed-methods approach. Thirty participants were recruited, with a final sample of fourteen completing the study. Quantitative data were collected via repeated measures of psychological flexibility, self-compassion, psychological distress, and mental wellbeing, and analysed primarily through visual inspection of graphed outcomes.

**Results:** Although the intervention did not yield consistent improvements in psychological flexibility, it showed evidence of adverse effects on self-compassion and psychological distress. Notably, enhancements in mental wellbeing were reported. Qualitative feedback provided a more positive image of the intervention, and participants reported perceived physical and psychological benefits.

**Conclusion**: The findings suggest that the psychological benefits of yoga may be more context-specific than previously assumed, highlighting the importance of tailored, inclusive interventions for supporting student mental health.

## Background

The prevalence of students reporting a mental health difficulty has risen in the United Kingdom (UK) from 0.4% in 2006-07 to 2% during 2015-16; however, the true prevalence is likely higher due to under-reporting (Thorley, 2017). During the global pandemic, prevalence rose further (Chen & Lucock, 2022). Mental health difficulties in students are linked to significant impairments in academic performance, quality of life and overall health (Jenkins et al., 2021). The increase in prevalence represents an important public health issue (Oswalt et al., 2020). Ninety-four per cent of UK education providers reported increased demand for counselling services over the last five years (Thorley, 2017). In the UK, students waited on average seven days for an initial counselling appointment, and up to eighteen days for a second appointment (Broglia et al., 2018). Students reported feeling embarrassed and only seeking help as a last resort when problems are severe (Laidlaw et al., 2016; Quinn et al., 2009). Counselling showed effectiveness in 40–55% of cases, though many services did not track outcomes with validated measures (Connell et al., 2008; Murray et al., 2016).

Universities often provide online self-help as part of stepped care, with students signposted to these resources prior to a referral for counselling (Cornish et al., 2017). Research has shown promising evidence for the use of online self-help in university students (Charbonnier et al., 2022; Newman et al., 2021; Wojtowicz et al., 2013). Students identified benefits of online support, including anonymity and flexible access, with some concerns around confidentiality (Chan et al., 2016). Given the rising prevalence of mental health difficulties among students and the barriers they face in accessing traditional counselling services, there is a pressing need for alternative interventions that are both accessible and effective. Yoga, a practice that has been extensively studied for its mental health benefits, may offer a promising avenue for students seeking self-help resources.

Yoga has been defined in the research literature as a multicomponent behavioural practice integrating physical movement, regulated breathing, and meditative practices designed to cultivate awareness, self-regulation, and

psychological wellbeing (Cramer et al., 2013; Gard et al., 2014) [1]. It is a popular, low-cost, and easily accessible self-help intervention which has been shown to alleviate symptoms of mental and physical health conditions and improve overall wellbeing in clinical and healthy populations (Brinsley et al., 2021; Deepeshwar & Kumar, 2022; Pascoe & Bauer, 2015; Uebelacker & Broughton, 2018). Research with students suggests that yoga improves health and wellbeing, with reports of increased mindfulness, self-control, and reduced anxiety and stress, with similar findings reported in a systematic review (Braun et al., 2019; Ciezar-Andersen et al., 2021; Lemay et al., 2019; Simard & Henry, 2009).[2] Online delivery is feasible and well received (Brosnan et al., 2021), and yoga is considered safe and effective both as a standalone and adjunctive treatment (Skowronek et al., 2014).

Although yoga is known to be effective at improving health outcomes, the mechanisms of change (MOC) that occur are not well understood (Matko et al., 2021; Riley & Park, 2015). There have been efforts in research to identify the MOC that occur through yoga practice, and some psychological mechanisms are supported in the literature, such as self-compassion (Gard et al., 2012; Riley & Park, 2015), psychological flexibility (Avery et al., 2018; Dick et al., 2014; Fox et al., 2024), and mindfulness (Dick et al., 2014; Meister & Juckel, 2018; Park et al., 2021). Notably, Fox et al. (2024) compared yoga practitioners with non-practitioners, reporting that yoga practice was associated with higher wellbeing and psychological flexibility, and that specific limbs of yoga, particularly ethical rules (*yama*) and physical postures (*asana*), predicted these outcomes. Mindfulness is often discussed in the literature as an MOC in yoga (Meister & Juckel, 2018; Park et al., 2021); however, it is part of the procedure that is taught in yoga, again adding to the lack of clarity in the literature.

Within the existing research, there is a lack of clarity in identifying and disentangling the procedure of yoga, the MOC, and the outcomes (Matko et al., 2021; Matko et al., 2022; Park et al., 2021). There is a need for further research

[1] See extended paper section 1.1 for a more detailed discussion of the historical and cultural context of yoga.

[2] See extended paper section 1.2 for more information around the general effectiveness of yoga.

to identify the MOC in yoga, thereby developing the existing evidence and refining our understanding of how yoga works. The unclear explanation of how yoga works limits its use in clinical settings as a recommended treatment (Riley & Park, 2015).[3] By gaining a better understanding of the MOC that occur, practitioners may be able to use yoga more precisely as a tool to promote mental and physical wellbeing.

Psychological flexibility is defined as the ability to remain in contact with the present moment and to mindfully experience both positive and negative internal events without attempting to avoid or control them (Strosahl et al., 2004).[4] It is considered the central MOC in ACT that underpins positive psychological outcomes (Kashdan & Rottenberg, 2010). ACT seeks to enhance psychological flexibility by teaching mindfulness and acceptance-based skills, and aiming to reduce experiential avoidance, which is viewed as a key cause of psychological distress (Doorley et al., 2020). Empirical research suggests that increased psychological flexibility is associated with reduced stress and enhanced wellbeing (Dawson & Golijani-Moghaddam, 2020; Lloyd et al., 2013; Puolakanaho et al., 2020; Wersebe et al., 2018). Within ACT research, psychological flexibility is a well-supported MOC that reduces distress through better coping and less avoidance (Ciarrochi et al., 2010; Kashdan & Rottenberg, 2010). In yoga research, there is preliminary evidence suggesting that psychological flexibility is an MOC that may lead to reductions in distress (Avery et al., 2018; Dick et al., 2014). However, much of the existing research is constrained by poor experimental control (Dick et al., 2014), and the use of the Acceptance and Action Questionnaire (AAQ-II), as the validity of this measure has been criticised (Wolgast, 2014; Tyndall et al., 2019).[5] More recently, Fox et al. (2024) provided further support, showing higher psychological flexibility in yoga practitioners compared to non-practitioners; however, sample demographics and lack of control over yoga styles limited findings.

Self-compassion relates to a person's ability to respond to their struggles, pain, and failures in a compassionate, mindful, and nurturing manner (Neff &

[3] See extended paper section 1.3 for a critical review of the literature exploring MOC in yoga.

[4] See extended paper section 1.4 for further information about ACT.

[5] See extended paper section 1.5 for information about the validity of the AAQ-II

Dahm, 2015). Developing self-compassion is the primary aim of Compassion Focused Therapy (CFT), which proposes that individuals with high levels of self-criticism and shame often struggle to be kind and compassionate towards themselves (Gilbert, 2009).[6] A meta-analysis of CFT interventions reported that increasing self-compassion led to improvements in psychological distress and mental wellbeing (Ferrari et al., 2019). In a systematic review of self-compassion-focused interventions for young people, it was reported that higher levels of self-compassion were associated with lower levels of anxiety and depression (Egan et al., 2021). In yoga research with students, Gorvine et al. (2019) reported that practising yoga or mindfulness increased self-compassion, and these increases predicted positive reductions in reports of perceived stress.

Building on this evidence, yoga as practised in the West aims to develop non-judgemental self-awareness through body movements, acceptance of the present moment through mindfulness, and the ability to harness physical discomfort when holding postures (Cox & Tylka, 2020). Theoretically, yoga can be seen as an intervention which may target the proposed mechanisms of psychological flexibility and self-compassion through these procedures (Bennetts, 2022; Fox et al., 2024; Kishida et al., 2019). Yoga may enhance psychological flexibility and self-compassion through shared embodied and mindfulness-based processes (Cox & Tylka, 2020). The sustained focus on present-moment awareness, acceptance of discomfort, and intentional values-based action in yoga relates to ACT's six core processes, which are linked to psychological flexibility (Hayes et al., 2006) and have been argued to target this concept (Bennetts, 2022; Fox et al., 2024). These same features also reflect the core components of self-compassion, including mindfulness, self-kindness, and a sense of shared humanity (Kishida et al., 2019; Neff, 2004). Taken together, this theoretical understanding suggests that yoga may reduce experiential avoidance and promote openness to complex thoughts, feelings, and sensations, while simultaneously developing a more compassionate relationship with oneself (Bennetts, 2022; Kishida et al., 2019).[7] Empirical studies suggest

[6] See extended paper section 1.6 for further information about CFT.
[7] See extended paper section 1.7 for more details about the aims and unique rationale of the study.

that these processes may mediate the relationship between yoga practice and reductions in psychological distress, with preliminary evidence linking yoga participation to greater psychological flexibility (Avery et al., 2018; Dick et al., 2014; Fox et al., 2024) and higher self-compassion (Gorvine et al., 2019; Kishida et al., 2019). This convergence of theory and evidence provides a coherent rationale for investigating yoga as a process-based intervention that can target these transdiagnostic MOC.

Clarifying these mechanisms is essential as yoga is already a widely used complementary and alternative treatment for various mental health difficulties. Providing reliable information about how and why yoga works strengthens the rationale for recommending it to consumers and clinicians (Gangadhar & Varambally, 2011). Developing a scientific understanding of how yoga works strengthens the rationale for recommending yoga as an intervention and may help increase clinicians' acceptance of yoga as a therapeutic approach (Riley & Park, 2015). The research on the psychological MOC in yoga provides preliminary evidence that yoga targets similar MOC as other psychological interventions for common mental health conditions (Bennetts, 2022; Kishida et al., 2019; O'Shea et al., 2022). Adding yoga as an integrated or adjunct part of the interventions is reported to improve outcomes and engagement in psychological interventions for depression, anxiety, and post-traumatic stress disorder (PTSD) (O'Shea et al., 2022). Understanding how yoga works will provide more clarity on the processes that occur during yoga, which mediate positive outcomes, and will allow the tailoring of yoga interventions to improve specific difficulties or develop specific skills. This means that yoga could be used in a more precise, efficacious, and evidence-based manner. This may help clinicians decide whether yoga is an appropriate self-help intervention to recommend or if it could be used to enhance the effectiveness of existing psychological interventions for individuals.

The original contribution to knowledge in this paper is the application of scientific rigour to examine the proposed psychological MOC in yoga with a clear differentiation of procedure, process, and outcome.[8] In existing reviews of

[8] See extended paper section 1.8 for more information about the relevance of ACT and CFT in the current study.

the literature exploring the psychological MOC in yoga, it is highlighted that many of the studies had poor methodological rigour, and there is a need for future research to address this issue (Meister & Juckel, 2018; Riley & Park, 2015). The current study aims to address this gap in the literature by providing a rigorous investigation into the processes of change in yoga that mediate positive effects on mental health and wellbeing. The research will also contribute by examining the potential utility of online yoga as an easy-to-implement self-help intervention for university students.

### Aims and Hypotheses

This study aimed to explore (1) whether a six-week online yoga intervention is effective in reducing psychological distress and improving mental wellbeing among students; and (2) whether psychological flexibility and self-compassion function as MOC that underpin positive outcomes.

It was hypothesised that a six-week online yoga intervention would lead to reductions in psychological distress and improvements in mental wellbeing, and that increases in psychological flexibility and self-compassion would underpin improvements in psychological distress.

## Methodology

### Ethics

The study received ethical approval from the University of Nottingham Mental Health and Clinical Neurosciences Research Ethics Sub-Committee (Ref 3154) (Appendix B).[9] Participants were provided with study information, gave informed consent, and were reminded that participation was voluntary with the right to withdraw at any stage (Appendix C).

### Design[10]

The current study employed a multiple single-case experimental design (SCED) with non-concurrent baselines to closely monitor changes in the

[9] See extended paper section 2.1 for more information about the ethical considerations.
[10] See extended paper section 2.2 for details on the epistemological position taken.

proposed mechanisms in individual cases. An A-B-A withdrawal design (Rassafiani & Sahaf, 2010) was employed, consisting of four weeks of baseline (A), six weeks of intervention (B), four weeks of washout (during which the intervention is removed), and two weeks of follow-up (A). SCEDs are used to systematically evaluate the effects of an intervention by repeatedly measuring process and outcome variables across the different phases of the study to examine the temporal relationship between variables (Smith, 2012).[11] A mixed-methods design was employed to gather qualitative data on the participants' adherence to the intervention and their perceptions of change (Hitchcock et al., 2010; Elliott et al., 2001). Advice from the Service User and Carer Advisory Panel led to a reduction in the duration of the intervention and the length of the video to minimise participant burden.[12]

**Recruitment**

Individuals were eligible to take part in the study if they were currently enrolled on a university course, over 18 years of age, not engaging in regular yoga practice, and were experiencing mild-moderate levels of psychological distress as measured by the Depression, Anxiety, Stress Scale-21 (DASS-21) (Lovibond & Lovibond, 1995). The DASS-21 was administered using QuestionPro as a screening measure at the beginning of the study. Individuals were excluded if they were experiencing severe or extremely severe psychological distress and were signposted to support services (Appendix D). It was an inclusion criterion that participants were physically able to practice yoga, able to follow instructions, and read in the English language (Appendix E).[13]

In SCED research, a minimum of three participants is required to determine the replication of an effect (Lane & Gast, 2014). Previous research indicates that at least 20% of participants would drop out (Vancampfort et al., 2021). However, due to the current study spanning across 16 weeks and requiring participants to engage in yoga, there was no pilot data that reflected the study closely enough to guide expectations.

[11] See extended paper section 2.3 for further details on the study design.
[12] See extended paper section 2.3.1 for more information about the service user involvement.
[13] See extended paper section 2.3.2. for further details on the inclusion and exclusion criteria.

Participants were recruited via social media, where the study recruitment poster was shared on a page specifically for student research projects (Appendix F). I aimed to recruit 10 participants, but 30 people took part; however, just under half (14) completed the study, which represents a large sample in terms of SCED research.[14] Most participants appeared to be older than the typical UK undergraduate age. Although the inclusion criteria did not specify an upper age limit, this pattern may reflect the increasing number of mature students who enter university courses in the UK (Bolton & Hubble, 2021).

**Demographics**

An overview of the participants' demographic information and baseline psychological distress as measured by the DASS-21 is provided in Table 1.

[14] See extended paper section 2.3.2 for more details on the recruitment process and sample size.

**Table 1**

*Demographic Information and Baseline DASS-21 Scores for Completers*[15]

| PP | Age | Gender | Ethnicity | Year of study | Overall DASS-21 | Depression | Anxiety | Stress |
|---|---|---|---|---|---|---|---|---|
| P1 | 33 | Male | White and Black African | 2nd | 38 | 15(Mod) | 11(Mod) | 12(N) |
| P2 | 33 | Female | Irish | 2nd | 37 | 10(N) | 14(Mod) | 13(N) |
| P3 | 24 | Male | White and Black African | 1st | 42 | 17(Mod) | 12(Mod) | 13(N) |
| P4 | 32 | Male | Mixed race | 1st | 39 | 15(Mod) | 12(Mod) | 12(N) |
| P5 | 28 | Male | English | 2nd | 38 | 12(Mild) | 11(Mod) | 15(Mild) |
| P6 | 30 | Male | English | F | 39 | 12(Mild) | 16(Sev)[16] | 11(N) |
| P7 | 25 | Male | Black/African/Caribbean | 3rd | 36 | 14(Mild) | 11(Mod) | 11(N) |
| P8 | 28 | Female | White and Black Caribbean | 3rd | 35 | 11(Mild) | 13(Mod) | 11(N) |
| P9 | 32 | Male | English | 3rd | 32 | 13(Mild) | 10(Mod) | 9(N) |
| P10 | 24 | Male | White and Black African | 3rd | 31 | 12(Mild) | 9(Mild) | 10(N) |
| P11 | 22 | Female | White and Black African | 2nd | 33 | 11(Mild) | 13(Mod) | 9(N) |
| P12 | 21 | Female | White and Black African | 2nd | 22 | 6(N) | 8(Mild) | 8(N) |
| P13 | 22 | Female | White and Black African | 3rd | 24 | 8(N) | 8(Mild) | 8(N) |
| P14 | 21 | Male | Black/African/Caribbean | 2nd | 23 | 9(N) | 8(Mild) | 6(N) |

*Note.* DASS-21: Depression, Anxiety, Stress Scale-21; PP: participant; N: Normal; Mod: Moderate; Sev: Severe; F: Foundation year.

## Measures[17]

### *Quantitative Measures*

The quantitative measures were chosen following a review of the literature around yoga and the MOC. They were selected based on their ability to reliably and validly determine change over time through repeated

[15] See extended paper section 2.4 to see the demographic and baseline distress table for dropouts.
[16] See extended paper section 2.3.2 for an explanation of why P6 was included despite meeting exclusion criteria.
[17] See extended paper section 2.5 for more information on the measures.

administration (see Table 2).[18] Considerations were made regarding the workload on participants, and shorter, revised versions of the measures were utilised to reduce participant workload. All the measures were administered through a secure server (QuestionPro) via an email link.

### *Qualitative Measures*

During the intervention phase, weekly diaries (Appendix G) were utilised to collect data on intervention fidelity, participant engagement, and any personal challenges or barriers encountered in practising yoga. The Client Change Interview (CCI) used was an adaptation of the original nine-item Change Interview (Elliott et al., 2001) (Appendix H). This was administered at the end of the intervention to capture participants' perceived changes related to the yoga intervention, their understanding of the source of these changes, and any challenging aspects of engaging with the intervention.[19]

[18] See extended paper section 2.5.1 for more details on the quantitative measures.
[19] See extended paper section 2.5.2 for more details on the qualitative measures.

**Table 2**

*Quantitative Measures Completed*

| Measure (Author) | Items and scoring | Psychometric properties | Phase/Frequency (number of times completed) | Description |
|---|---|---|---|---|
| CompACT-10 (Psychological Flexibility PF) (Golijani-Moghaddam et al., 2023). | 10 items on a six-point Likert scale (0=strongly disagree, 6=strongly agree).<br><br>3 subscales (openness to experience, behavioural awareness, and valued actions).<br><br>Scoring range 0-60, higher scores indicate greater PF. Reliable change for CompACT-10 is a difference of 10 (Golijani-Moghaddam et al., 2023). | The subscales have high internal consistency; openness to experience α=.83, behavioural awareness α=.82, and valued actions α=.82. The measure showed good validity with moderate to large correlations with theoretically relevant measures, suggesting good convergent validity (Golijani-Moghaddam et al, 2023).<br><br>The test-retest reliability was reported to be excellent, .83 over a two-week interval (Golijani-Moghaddam et al, 2023). | Baseline/ weekly (4)<br><br>Intervention/ weekly* (4)<br><br>Washout/ weekly* (4) | The questions ask to provide how much a person agrees with statements such as 'I rush through meaningful activities without being really attentive to them' |
| SCS-SF (Self-Compassion) (Raes, 2011). | 12 items on a five-point Likert scale (1=never, 5=almost always).<br><br>The SCS-SF failed to support the same six-factor structure of the SCS (Hayes et al., 2016). Therefore, it was only used to assess overall scores.<br><br>Scoring range 12-60, higher scores indicate higher levels of SC. Reliable change for SCS-SF is a difference of 8. (Neff et al., 2021). | The measure has adequate internal consistency (α=.86) and concurrent validity as it correlates strongly to the original SCS (*r* >.97) (Kotera & Sheffield, 2020).<br><br>The test-retest reliability suggests good stability over time (*r*=.70-.85) (Raes et al., 2011). | Baseline/ weekly (4)<br><br>Intervention/ weekly* (4)<br><br>Washout/ weekly (4) | The questions ask to indicate 'how I typically act towards myself in difficult times', and the items present situations such as 'when I fail at something important to me, I become consumed by feelings of inadequacy' and for the person to rate how frequently this occurs. |

| Measure (Author) | Items and scoring | Psychometric properties | Phase/Frequency (number of times completed) | Description |
|---|---|---|---|---|
| DASS-21 (Depression, Anxiety, Stress Scale-21; Psychological Distress) (Lovibond & Lovibond, 1995). | 21- items on a four-point Likert scale (0= did not apply to me, 3= applied to me very much or most of the time).<br>3 subscales (depression, anxiety, stress)<br>Scoring range (0-126), higher scores indicate higher levels of PD.<br>Reliable change for DASS21 is a difference of 6 (Crawford & Henry, 2010). | The subscales have high internal consistency, depression α=.94, anxiety α=.87, and stress α=.91 (Antony et al., 1998). The subscales also showed high convergent validity of the constructs, and they correlated with existing measures of depression (*r*=.78), anxiety (*r*=.72), and stress (*r*=.67) (Henry & Crawford, 2005).<br>The test-retest reliability is good for each subscale: depression, .77; anxiety, .89; and stress, .85 (Asghari & Dibajnia, 2008). | Screening/ initial (1)<br>Intervention/midpoint (1)<br>Intervention/endpoint (1)<br>Follow-up/weekly (2) | The items ask how often statements such as 'I found myself getting agitated' (stress) have occurred over the last week. The responses are |
| SWEMWBS (Short Warwick Edinburgh Scale) (Stuart-Brown et al., 2009) | 7 items on a five-point Likert scale (1= none of the time, 5= all of the time).<br>Scoring range (7-35), higher scores indicate higher levels of mental wellbeing.<br>Reliable change for SWEMWBS is a difference of 4 (Ng Fat et al., 2017). | The measure has high internal reliability (α = .84) and good internal consistency (α = .76-.89)89 (Ng Fat et al., 2007). The measure displayed good convergent validity as it showed moderate to high correlations with theoretically relevant measures (Vaingankar et al., 2017)<br>The test-retest reliability is moderate, .70 (Sun et al., 2019). | Screening/ initial (1)<br>Intervention/midpoint (1)<br>Intervention/endpoint (1)<br>Follow-up/weekly (2) | The items ask to respond to statements such as 'I've been feeling optimistic about the future' and to indicate how much that described experiences over the last two weeks. |

*Note:* Psychometric properties of quantitative measures administered.
* During the intervention phase, there was an error in sending the survey links, and weeks 3 and 6 were missed in this phase.[20]
α=Alpha Coefficient, *r*= Pearson Correlation Coefficient

[20] See extended paper section 2.5.3 for further information about the missed process measures within the intervention phase.

## Procedure

### *Baseline*

The baseline phase established participants' typical responding prior to intervention and served as the comparison point for evaluating change (Smith, 2012). The process measures (CompACT-10, SCS-SF) were collected weekly for four weeks, providing 3–5 data points, as recommended in SCED (Lane & Gast, 2014). To mitigate the impact of any instability in baseline data, Fisher's dual criteria (DC) method was employed during analysis. This approach strengthens visual analysis by incorporating both statistical thresholds and trend lines to assess whether observed changes are likely due to the intervention rather than natural variability (Fisher et al., 2003).

### *Intervention*

Participants received a weekly link to a pre-recorded Hatha yoga video specifically designed for this study, which incorporated postures, breathing exercises, and meditation. They were asked to practice daily or as often as possible. The video was specifically designed for the study (see Table 3) and was an adaptation of an intervention described in existing research (Uebelacker et al., 2018).[21] Process measures (CompACT-10, SCS-SF) and weekly diaries were collected throughout the study. Outcome measures (DASS-21, SWEMWBS) were administered at midpoint and post-intervention, with the Client Change Interview (CCI) completed at the end of the intervention.

### *Washout*

The washout phase involved the continued collection of weekly process measures; participants were asked to stop practising yoga, and access to the intervention video was removed. This phase assessed whether any observed effects during the intervention were sustained, diminished, or reversed once the intervention was withdrawn. Including a washout phase is particularly valuable in SCED research, as it strengthens internal validity by helping to determine the maintenance of intervention effects over time (Smith, 2012).

[21] See extended paper section 2.6 for more information about the development of the intervention and a description of the intervention used in Uebelacker et al. (2018).

### *Follow-up*

Two follow-ups occurred four and six weeks post-intervention, and participants completed the outcome measures (DASS-21, SWEMWBS). The study procedure is outlined in Figure 1.

**Table 3**

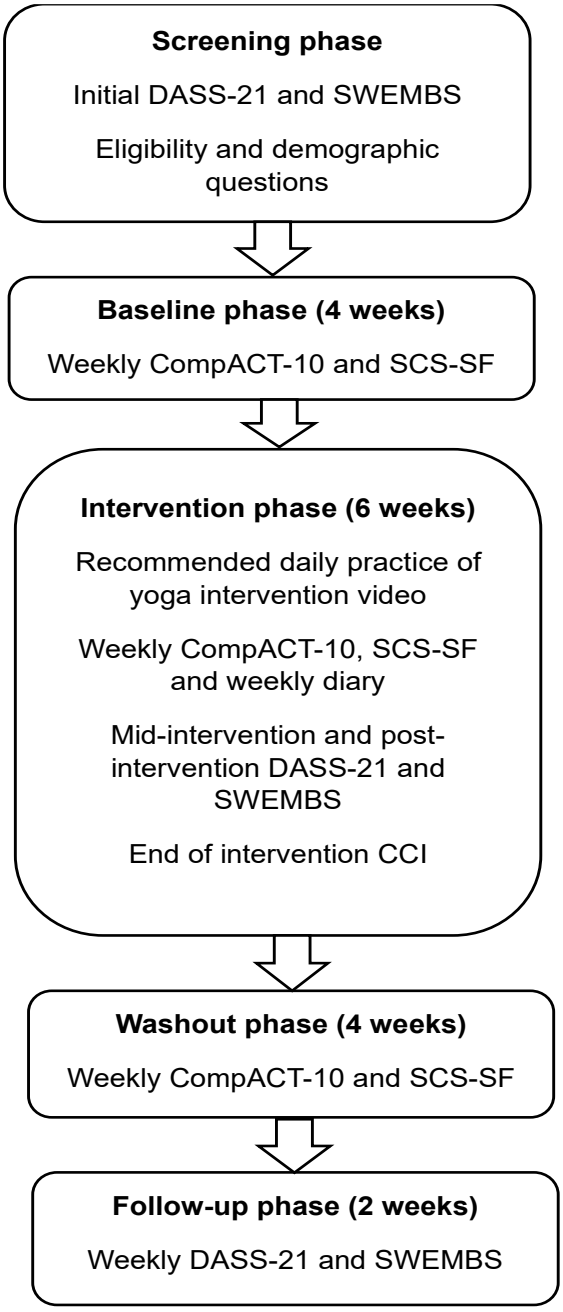
*Breakdown of 30-minute Yoga Intervention Video*

| Yoga Component | Time Allocated | Description |
|---|---|---|
| Greeting and safety message | 3 minutes | The yoga teacher will welcome the participants to the practice and inform them that all postures are optional and to practice within their body's limits. |
| Warm-ups (Asanas) | 10 minutes | Warm up postures include cat-cow, puppy pose, standing forward fold, standing cat/cow, standing swings, prayer pose, and breath of joy. Humming bee breath was used to create a sense of relaxation and focus. |
| Breathing practices (Pranayama) | 5 minutes | While in a seated position, participants are guided through a breathing practice where they are directed to pay attention to their breathing and achieve a 'fuller' breath. |
| Standing and Floor postures (Asanas) | 7 minutes | Postures including warrior one and warrior two (on each side), participants gently flowed in and out of each pose before holding, and the movement is attuned to the breath pattern. This was followed by floor postures, sphynx or cobra, child's pose, wind-relieving pose, and knee down twist. |
| Guided Relaxation | 5 minutes | Participants are invited into the final resting pose, lying flat on their backs, with their attention guided to different parts of the body and a focus on breathing. |

*Note.* Intervention breakdown based on Uebelacker et al. (2018) and consultation with a qualified yoga instructor.

**Figure 1**

*Study Procedure*




*Note.* The figure displays a breakdown of the participants' experience of taking part in the research, the duration of each phase of the study and the measures completed. DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; CompACT-10: measure of Psychological Flexibility; SCS-SF: Self-Compassion Scale-Short Form; CCI: Client Change Interview.

## Analysis[22]

To assess whether yoga, as practised in this study, influenced the proposed MOC, quantitative data from the process measures were analysed. Scores from each participant were plotted across the phases of the SCED (baseline[23], intervention, and washout) and examined using visual analysis procedures described by Lane and Gast (2014).[24] This involved inspecting level, trend, and variability within and across phases, as well as the immediacy of effect, consistency of data patterns, and overlap between phases. Visual analysis was chosen as it is the recommended primary method for interpreting SCED data, enabling the detection of functional relationships between the intervention and changes in the process variables (Kratochwill et al., 2010).

To determine whether changes in the process variables were accompanied by changes in the outcome variables of psychological distress and mental wellbeing. The data were summarised into bar charts for each participant using data collected at screening, midpoint, post-intervention, and follow-up one and two. This allowed for a clear visual comparison of changes over time and facilitated the identification of a relationship between improvements in psychological flexibility and self-compassion and reductions in psychological distress or improved wellbeing.

Treatment effectiveness was quantified using the Percentage of data points Exceeding the Median (PEM; Ma, 2006), with the baseline median serving as the reference point. PEM values range from 0 (strong negative effect) to 1 (strong positive effect). Effect sizes were interpreted using Ma's (2006) guidelines, whereby scores ≥ .90 indicate a highly effective treatment, scores between .70 and .89 indicate moderate effectiveness, and scores < .70 are considered questionable or ineffective. Values around .50 suggest no clear effect, while values < .50 may indicate a possible adverse effect. In addition, the Dual Criterion (DC) method (Fisher et al., 2003) was applied to supplement PEM and visual analysis[25]. This method involves counting the number of data

[22] See extended paper section 2.7 for more details on the analysis.
[23] See extended paper section 2.7.1 for information on how baseline stability was determined.
[24] See extended paper section 2.7.2 for more information on visual analysis.
[25] See extended paper section 2.7.3 for further details on the use of effect size and Fishers dual criteria.

points in the intervention phase that fall above both the baseline median and the projected baseline trend line (Swoboda et al., 2010). The DC approach is considered more conservative than the PEM and visual inspection alone and is associated with fewer Type I errors and increased power to detect genuine treatment effects. This dual-method approach enables both the quantitative estimation of effect size and stronger inferential conclusions regarding the impact of the intervention.

To determine if the individual changes observed were reliable (above what could be attributed to chance or measurement error at 95% confidence) and clinically significant (the scores indicate movement from clinical to non-clinical range), Jacobson and Truax's (1991) Reliable Change Index (RCI) was applied to the scores. If reliable change was indicated, Clinically Significant Change (CSC) was assessed using normative data from published research to determine clinical cut-offs: CompACT-10 (Golijani-Moghaddam et al., 2023), SCS-SF (Neff et al., 2021), DASS-21 (Crawford & Henry, 2010), and SWEMWBS (Ng Fat et al., 2017).[26]

The qualitative data gathered through the Client Change Interview (CCI) were summarised and organised using framework analysis. Framework analysis was used to organise the data into themes (Ritchie & Spencer, 1994).[27] The seven stages of framework analysis were followed as described in Gale et al. (2013) (see Table 10). This was analysed in conjunction with the quantitative data to triangulate additional information about the participants' experience of the intervention and to gain an understanding of the direction of change.

## Results

### Participants

Thirty participants were recruited for the study, and sixteen (53.33%) dropped out. Participants received weekly email links to the intervention video and measures, along with two prompts to complete. If a participant failed to

[26] See extended paper section 2.7.4 for further details on the use of RCI and CSC.
[27] See extended paper section 2.7.5 for further information on the qualitative analysis.

complete the intervention and/or measures within one week, they were notified and removed from the study.

Overall, 18 women and 12 men were recruited; of these, nine men (75%) and five women (27.77%) completed the study. A chi-squared test of independence revealed a significant moderate to strong association between gender and study completion, $\chi^2(1, N = 30) = 6.45$, $p = .011$, Cramér's $V=.46$, with men significantly more likely to complete the study than women. Those who completed the study were significantly older (M=26.78, SD=4.61), than dropouts (M=21.81, SD=1.16), $t(28)=$, $p<.001$, $d=1.52$. A diverse range of participants from nine different ethnic backgrounds took part in the study. However, nearly half (46.66%) of all completers and dropouts were from a White and Black African background (see Tables 1 and 7).

An independent-samples t-test was conducted to compare baseline DASS-21 scores between participants who completed the study and those who dropped out. Completers had significantly higher levels of psychological distress at baseline (M = 33.5, SD = 6.41) than those who dropped out (M = 28.31, SD = 4.26), $t(28) = 2.64$, $p = .007$, $d = .96$. The effect size suggests a large difference between the two groups in overall baseline psychological distress. This suggests that participants with higher baseline symptoms of psychological distress were more likely to engage with and complete the study (see Tables 1 and 7).[28]

**Visual Analysis of Change[29]**

[28] See extended paper section 3.1 for a more detailed comparison of the completers and dropouts.
[29] See extended paper section 3.2 (3.2.1-3.2.14) for a detailed summary of results for each participant.

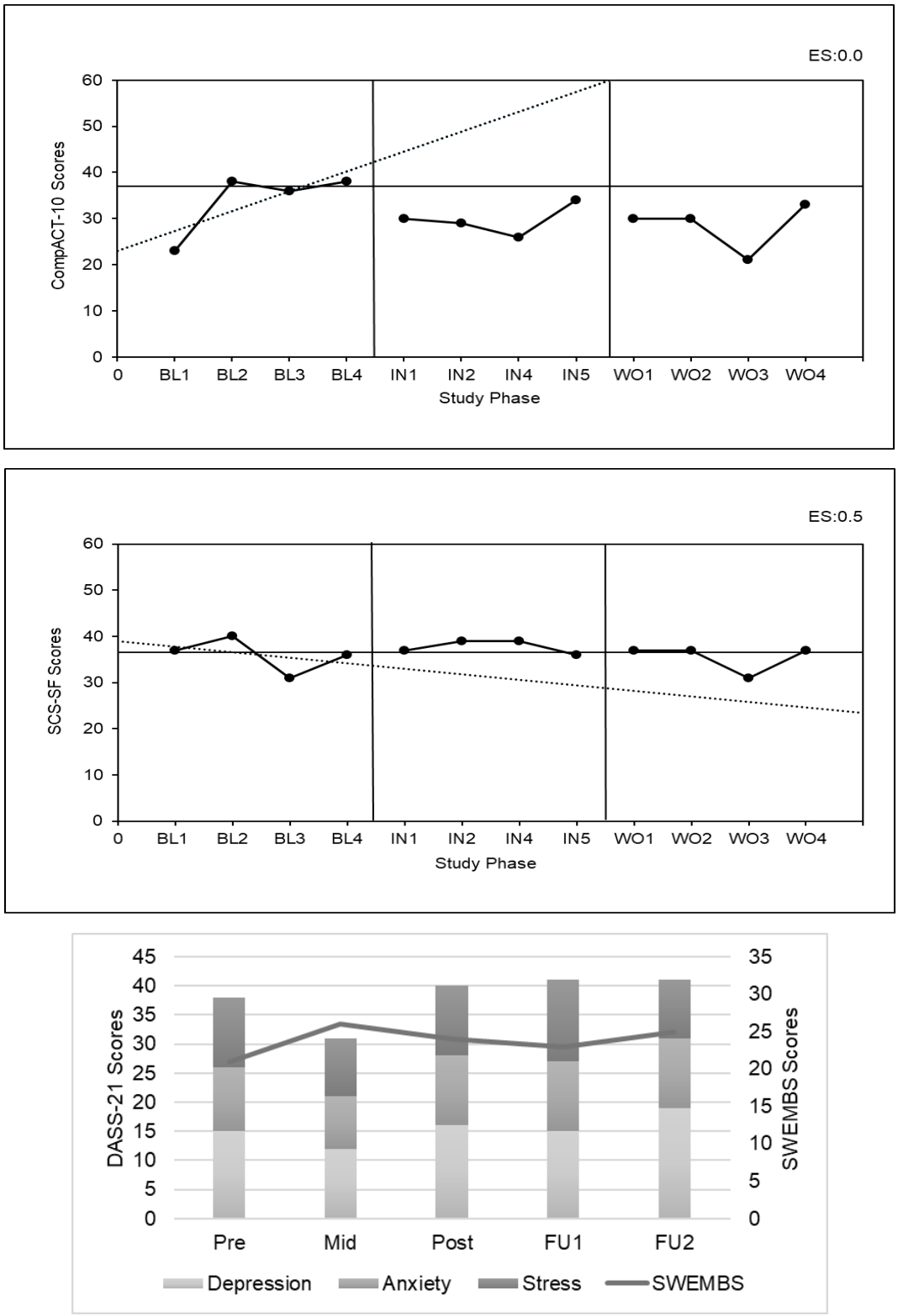



*Figure 2.* Participant One graphed time-series data of in-session process measures, baseline median is indicated by a solid line and the trend line is indicated by a dashed line. Solid vertical lines indicate the stages of the study: BL1-4 (baseline), IN1-5 (intervention), and WO1-4 (wash-out). ES: treatment Effect Size; SCS-SF: Self-Compassion Scale Short-Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; Pre: pre-intervention; Mid: midpoint; Post: post-intervention; FU1: follow-up one; FU2: follow-up two.

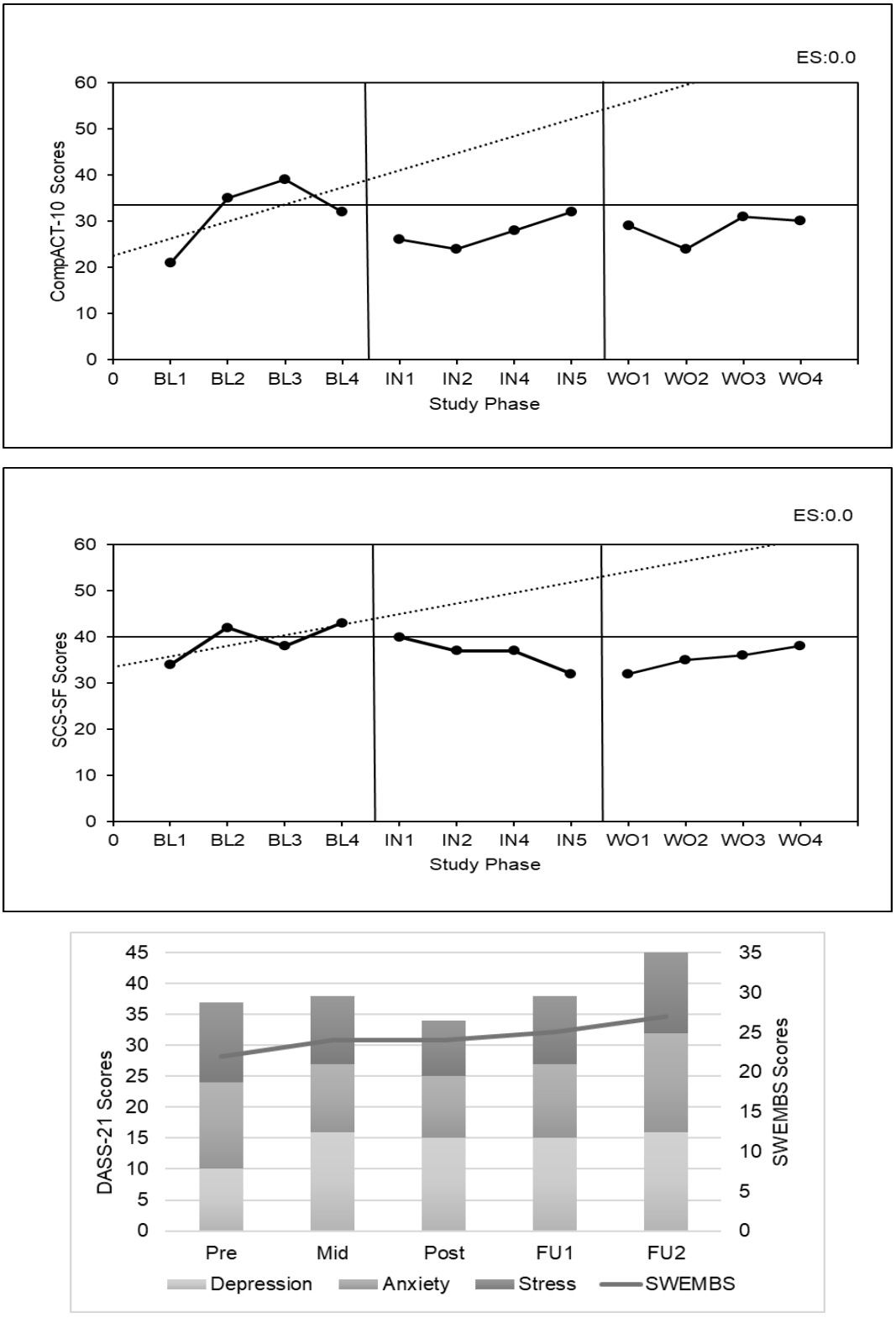
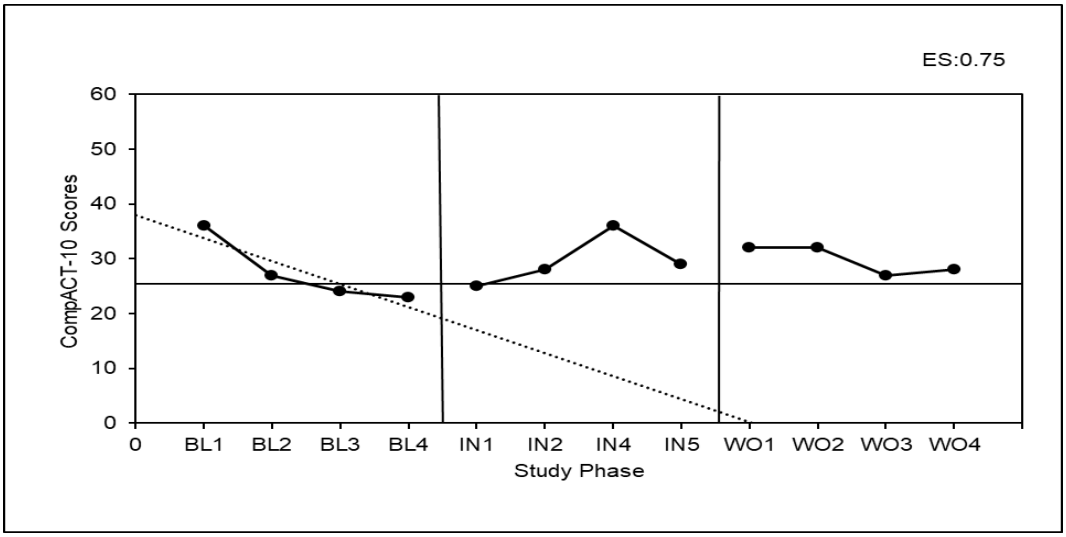
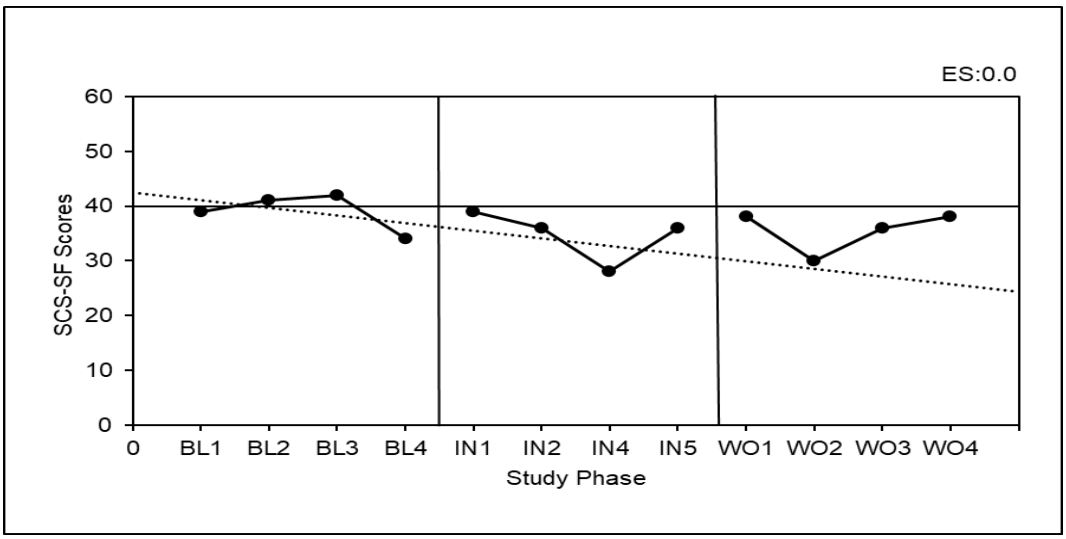



*Figure 3.* Participant Two graphed time-series data of in-session process measures, baseline median is indicated by a solid line and the trend line is indicated by a dashed line. Solid vertical lines indicate the stages of the study: BL1-4 (baseline), IN1-5 (intervention), and WO1-4 (wash-out). ES: treatment Effect Size; SCS-SF: Self-Compassion Scale Short-Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; Pre: pre-intervention; Mid: midpoint; Post: post-intervention; FU1: follow-up one, FU2: follow-up two.



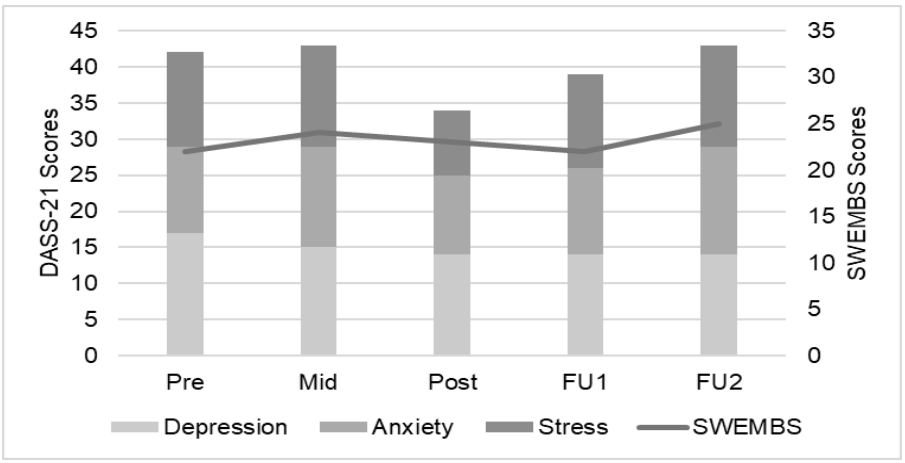
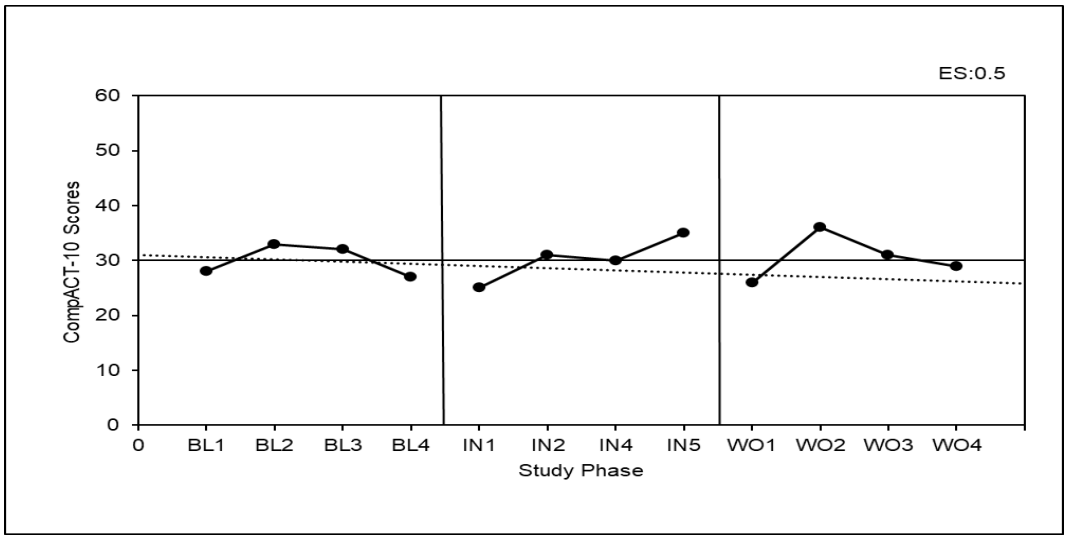
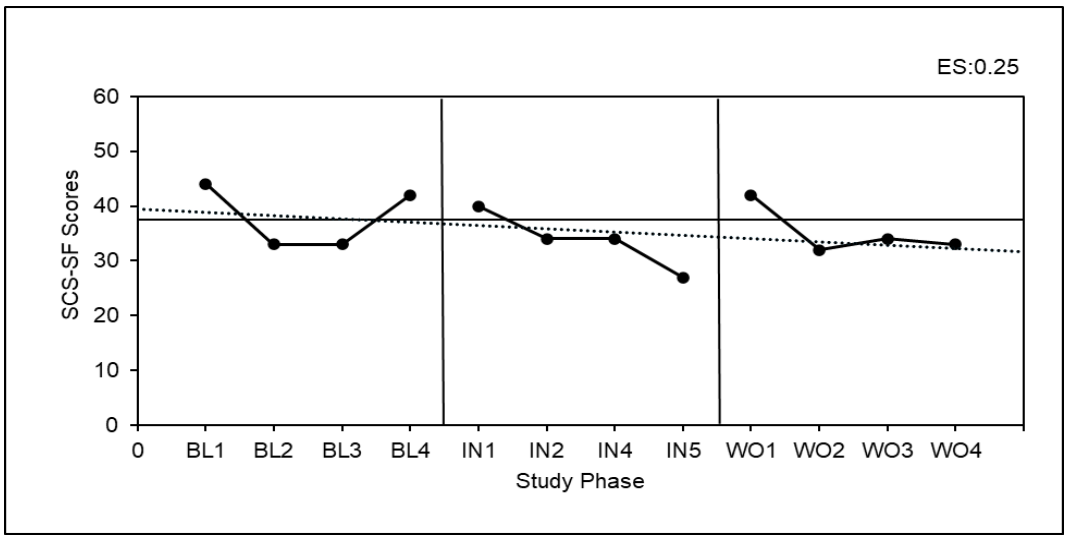




*Figure 4.* Participant Three graphed time-series data of in-session process measures, baseline median is indicated by a solid line and the trend line is indicated by a dashed line. Solid vertical lines indicate the stages of the study: BL1-4 (baseline), IN1-5 (intervention), and WO1-4 (wash-out). ES: treatment Effect Size; SCS-SF: Self-Compassion Scale Short-Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; Pre: pre-intervention; Mid: midpoint; Post: post-intervention; FU1: follow-up one; FU2: follow-up two.



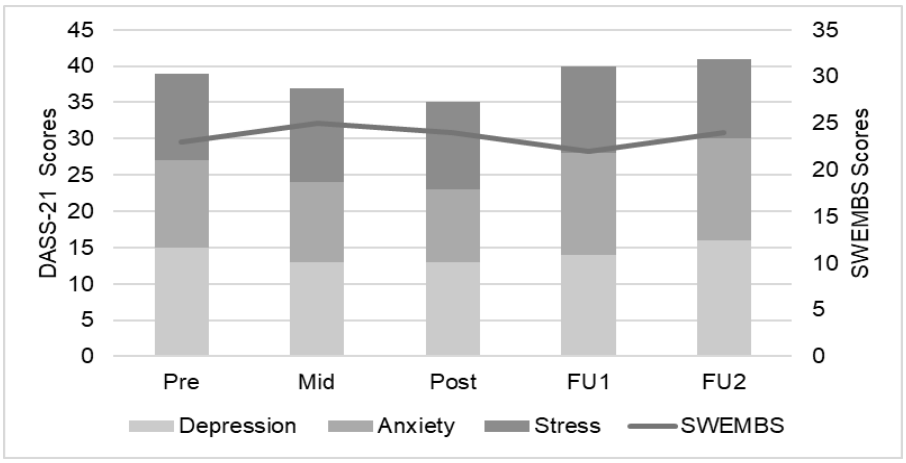
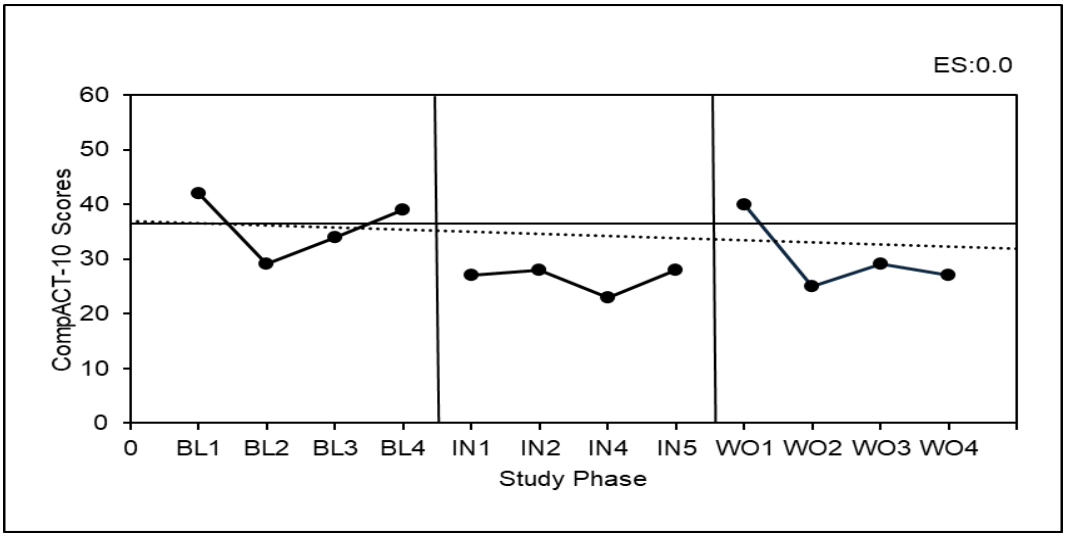
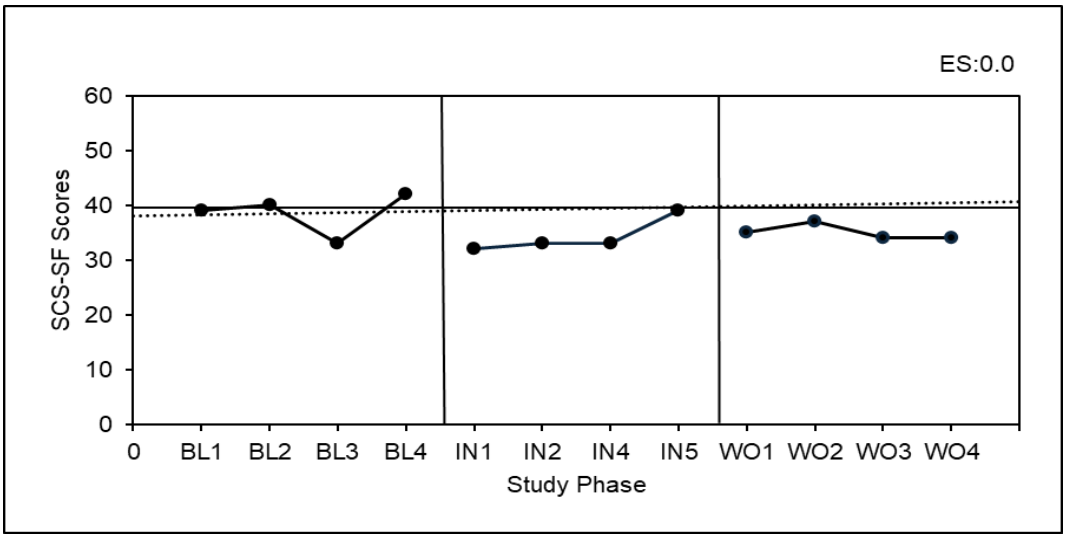




*Figure 5.* Participant Four graphed time-series data of in-session process measures, baseline median is indicated by a solid line and the trend line is indicated by a dashed line. Solid vertical lines indicate the stages of the study: BL1-4 (baseline), IN1-5 (intervention), and WO1-4 (wash-out). ES: treatment Effect Size; SCS-SF: Self-Compassion Scale Short-Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; Pre: pre-intervention; Mid: midpoint; Post: post-intervention; FU1: follow-up one; FU2: follow-up two.



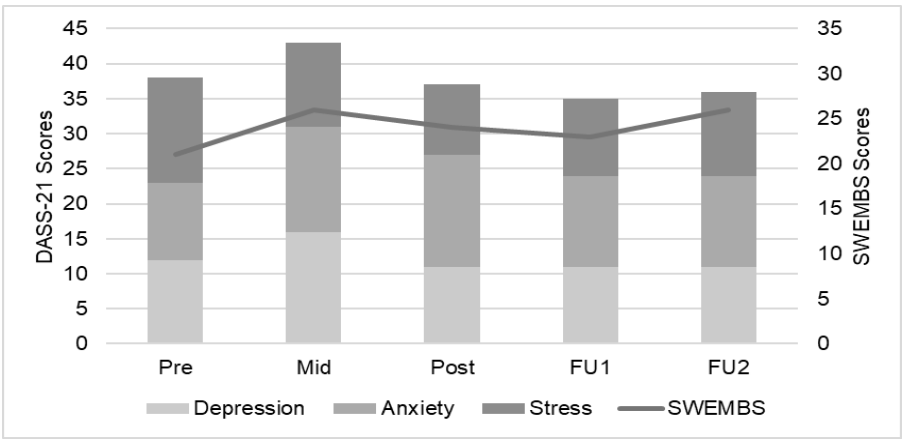




*Figure 6.* Participant Five graphed time-series data of in-session process measures, baseline median is indicated by a solid line and the trend line is indicated by a dashed line. Solid vertical lines indicate the stages of the study: BL1-4 (baseline), IN1-5 (intervention), and WO1-4 (wash-out). ES: treatment Effect Size; SCS-SF: Self-Compassion Scale Short-Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; Pre: pre-intervention; Mid: midpoint; Post: post-intervention; FU1: follow-up one; FU2: follow-up two.

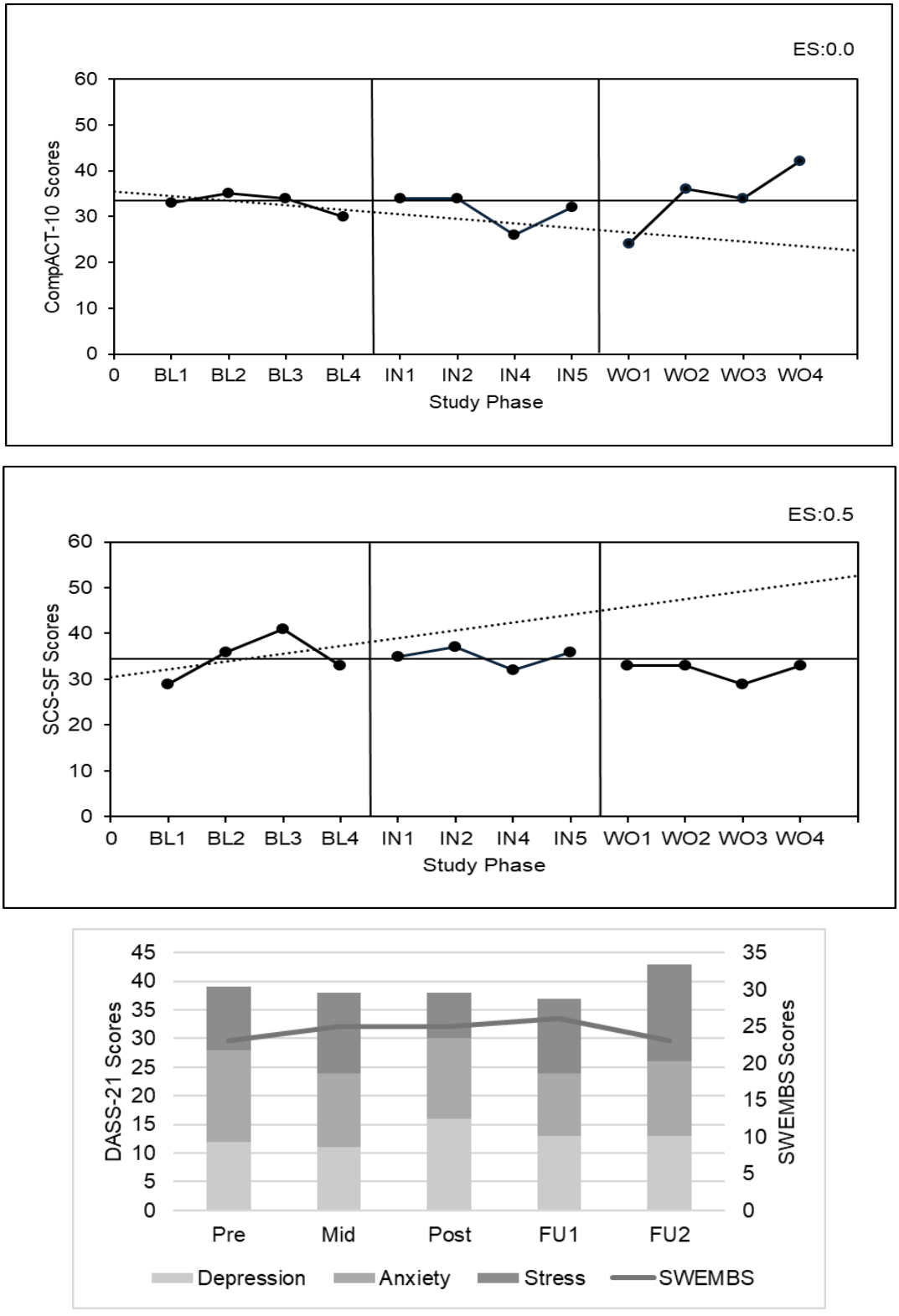



*Figure 7.* Participant Six graphed time-series data of in-session process measures, baseline median is indicated by a solid line and the trend line is indicated by a dashed line. Solid vertical lines indicate the stages of the study: BL1-4 (baseline), IN1-5 (intervention), and WO1-4 (wash-out). ES: treatment Effect Size; SCS-SF: Self-Compassion Scale Short-Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; Pre: pre-intervention; Mid: midpoint; Post: post-intervention; FU1: follow-up one; FU2: follow-up two.

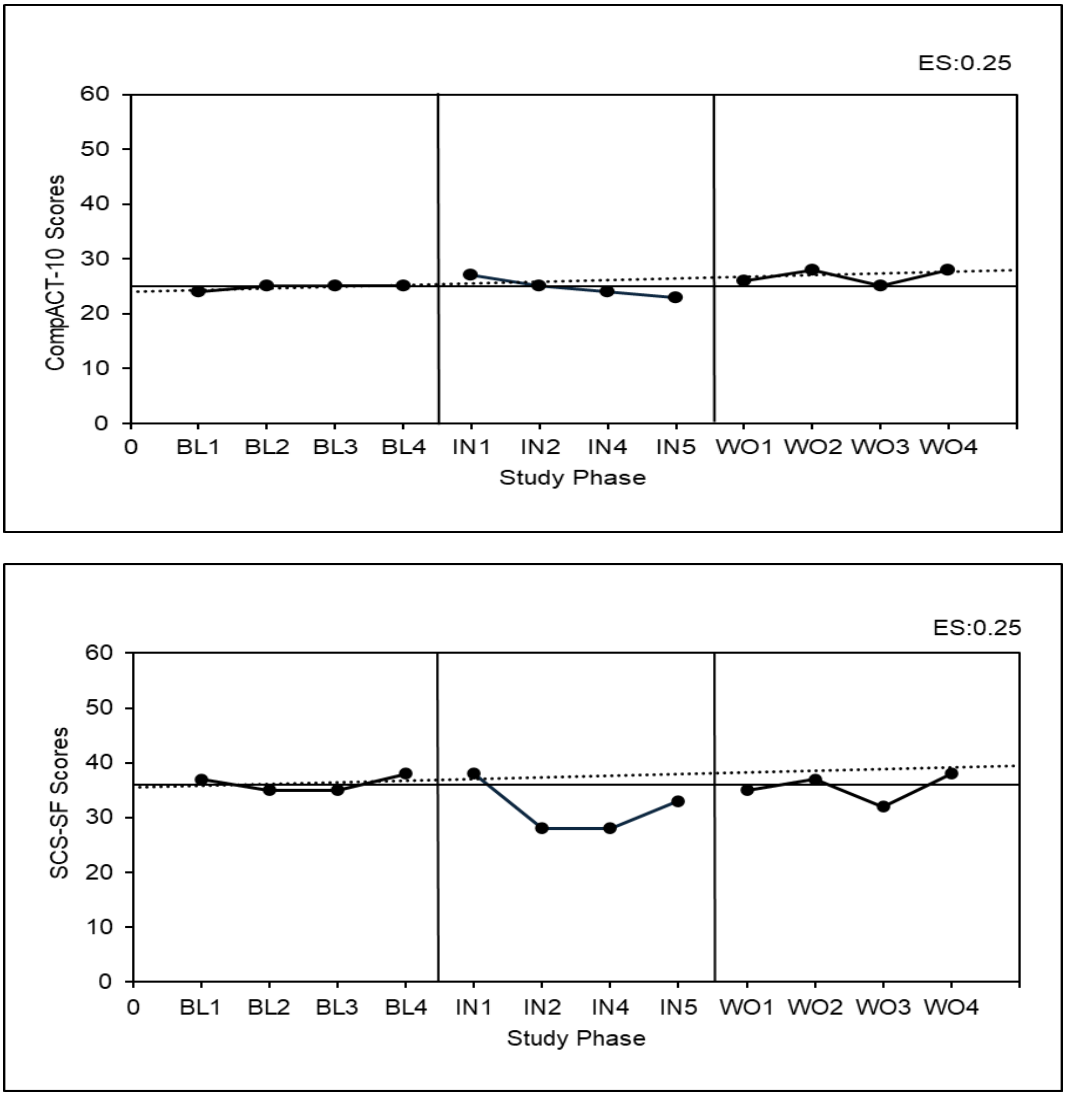
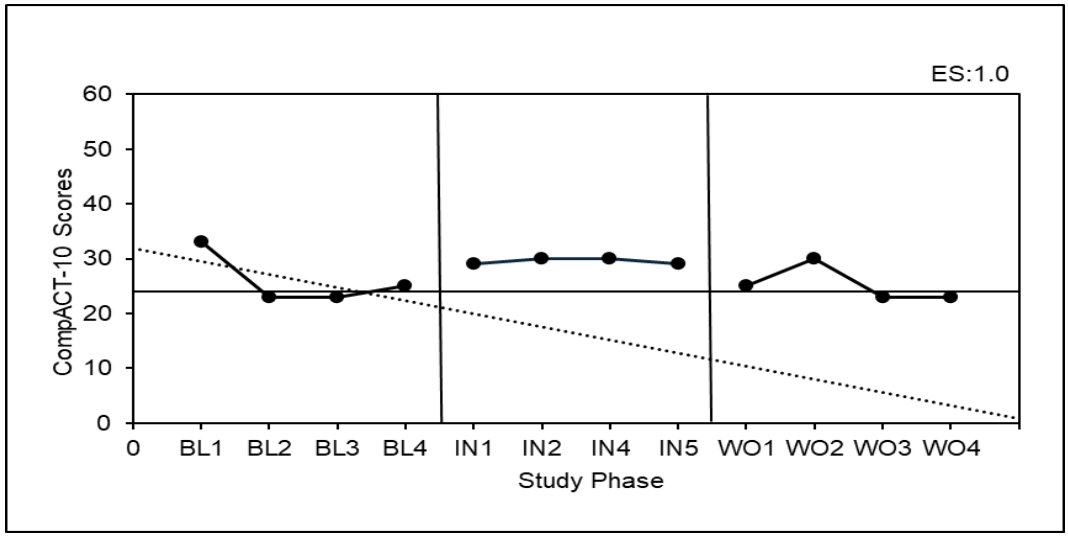
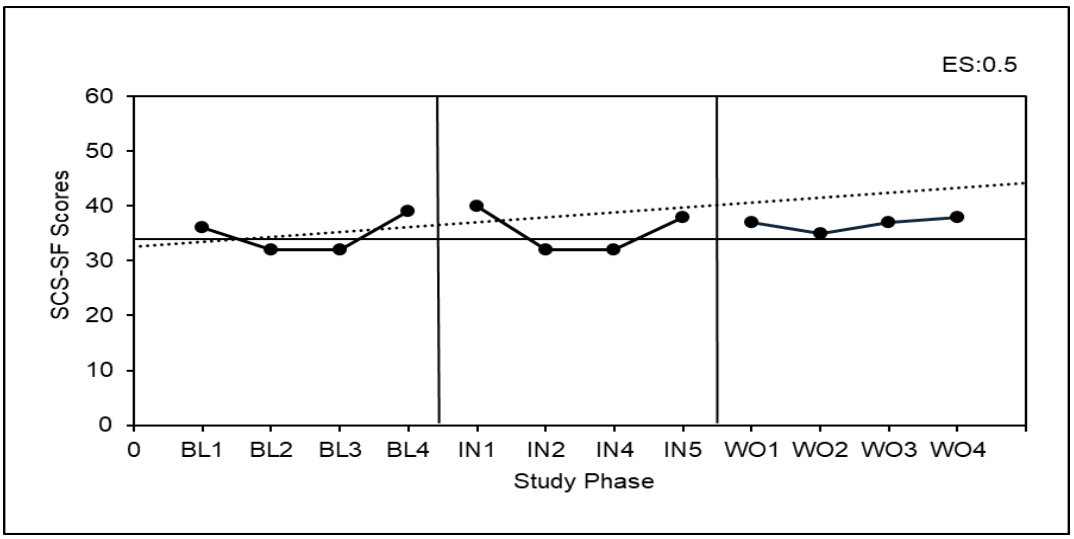



*Figure 8.* Participant Seven graphed time-series data of in-session process measures, baseline median is indicated by a solid line and the trend line is indicated by a dashed line. Solid vertical lines indicate the stages of the study: BL1-4 (baseline), IN1-5 (intervention), and WO1-4 (wash-out). ES: treatment Effect Size; SCS-SF: Self-Compassion Scale Short-Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; Pre: pre-intervention; Mid: midpoint; Post: post-intervention; FU1: follow-up one; FU2: follow-up two.



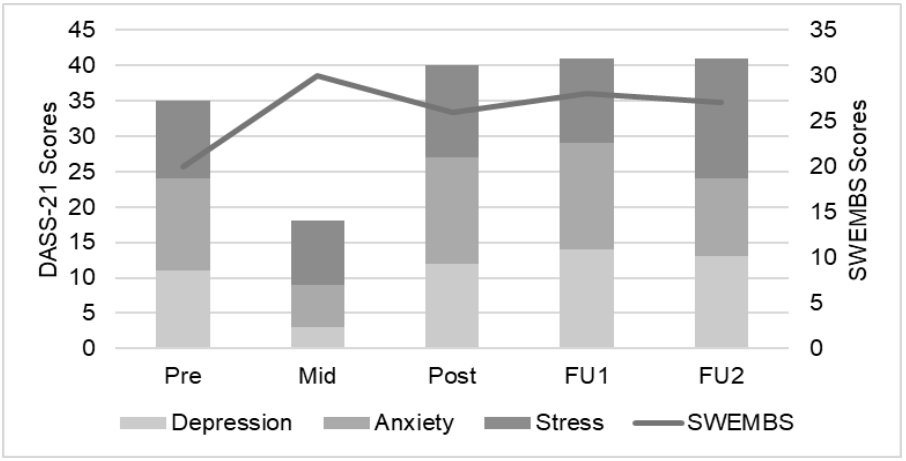




*Figure 9.* Participant Eight graphed time-series data of in-session process measures, baseline median is indicated by a solid line and the trend line is indicated by a dashed line. Solid vertical lines indicate the stages of the study: BL1-4 (baseline), IN1-5 (intervention), and WO1-4 (wash-out). ES: treatment Effect Size; SCS-SF: Self-Compassion Scale Short-Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; Pre: pre-intervention; Mid: midpoint; Post: post-intervention; FU1: follow-up one; FU2: follow-up two.

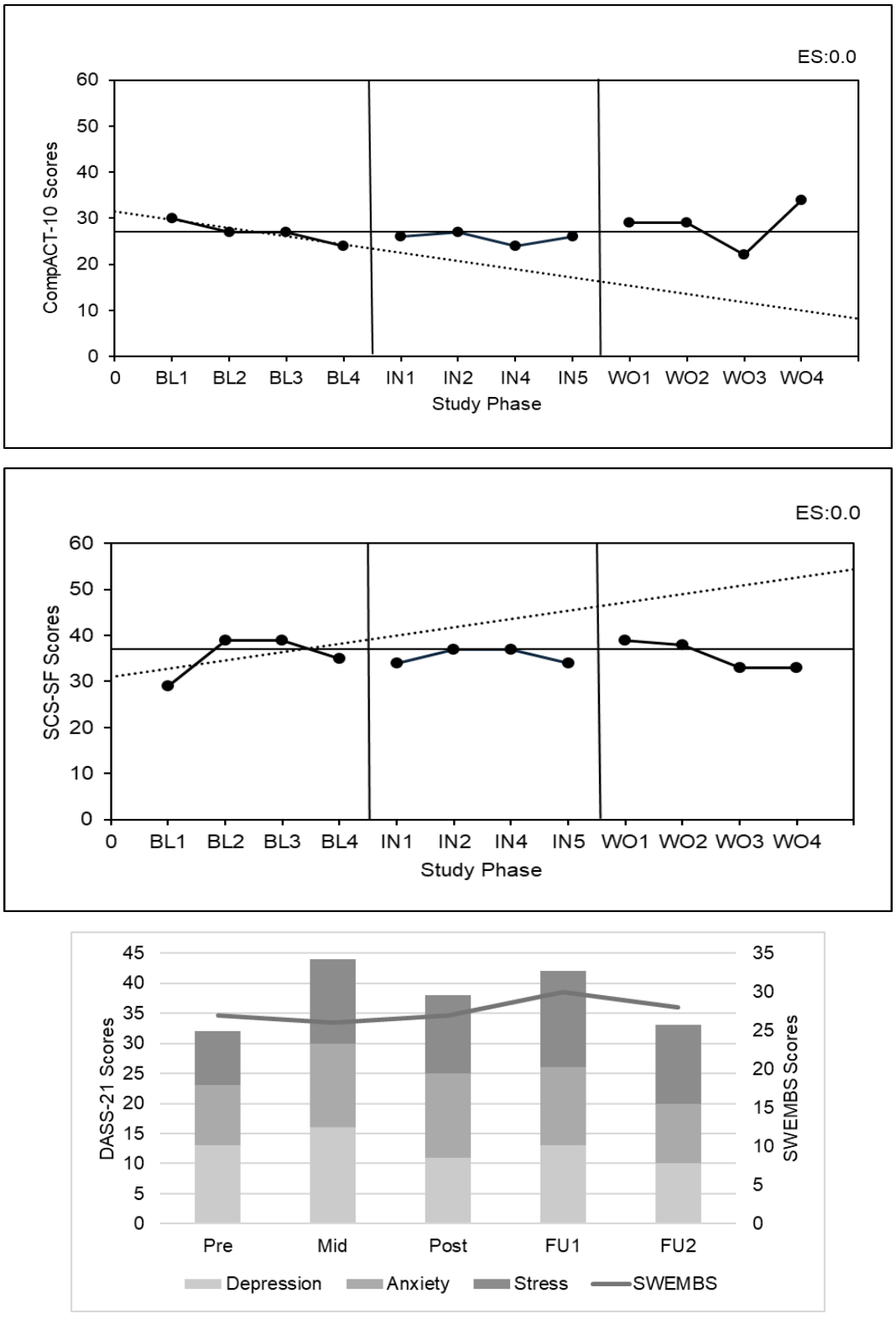
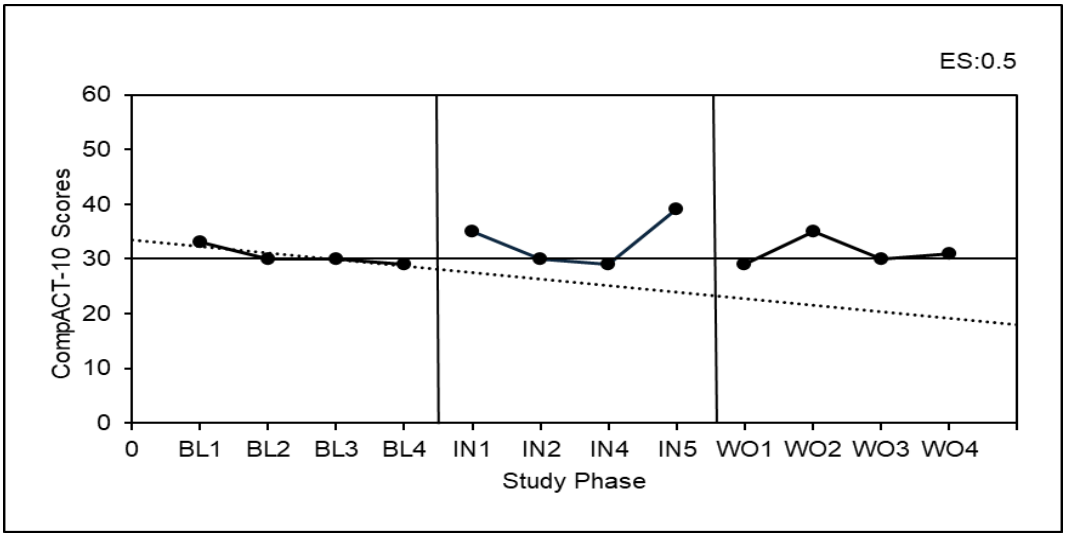
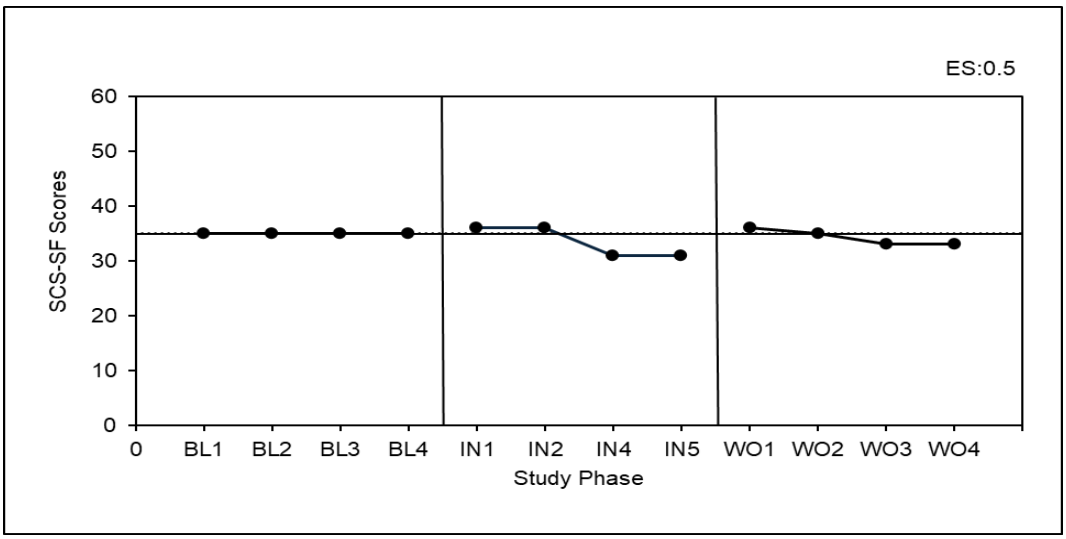



*Figure 10.* Participant Nine graphed time-series data of in-session process measures, baseline median is indicated by a solid line and the trend line is indicated by a dashed line. Solid vertical lines indicate the stages of the study: BL1-4 (baseline), IN1-5 (intervention), and WO1-4 (wash-out). ES: treatment Effect Size; SCS-SF: Self-Compassion Scale Short-Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; Pre: pre-intervention; Mid: midpoint; Post: post-intervention; FU1: follow-up one; FU2: follow-up two.



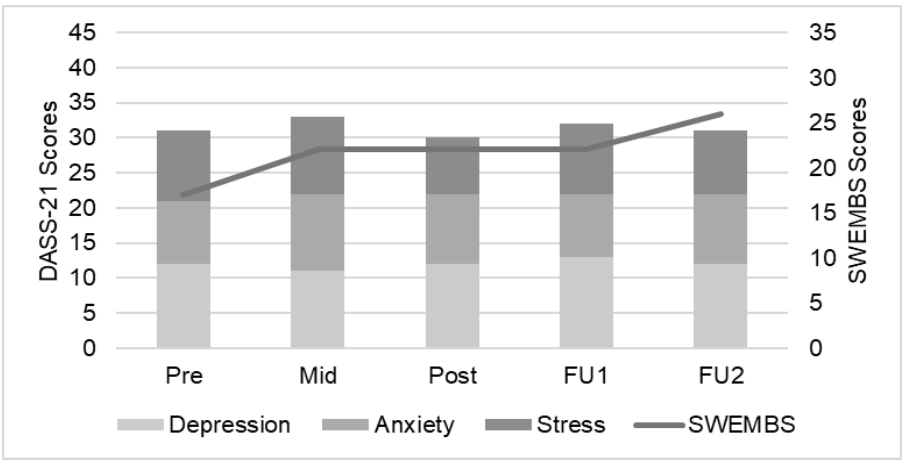
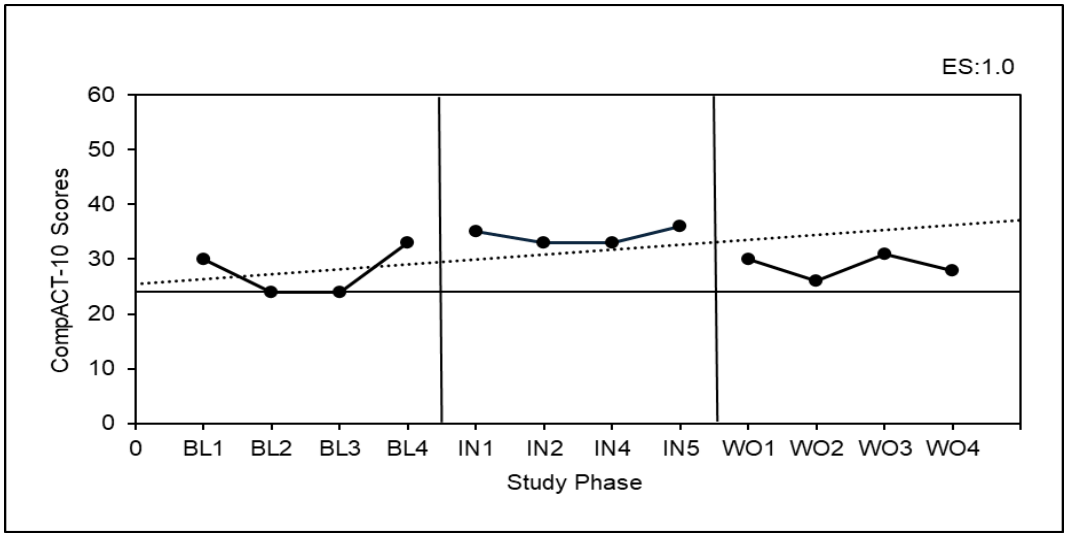
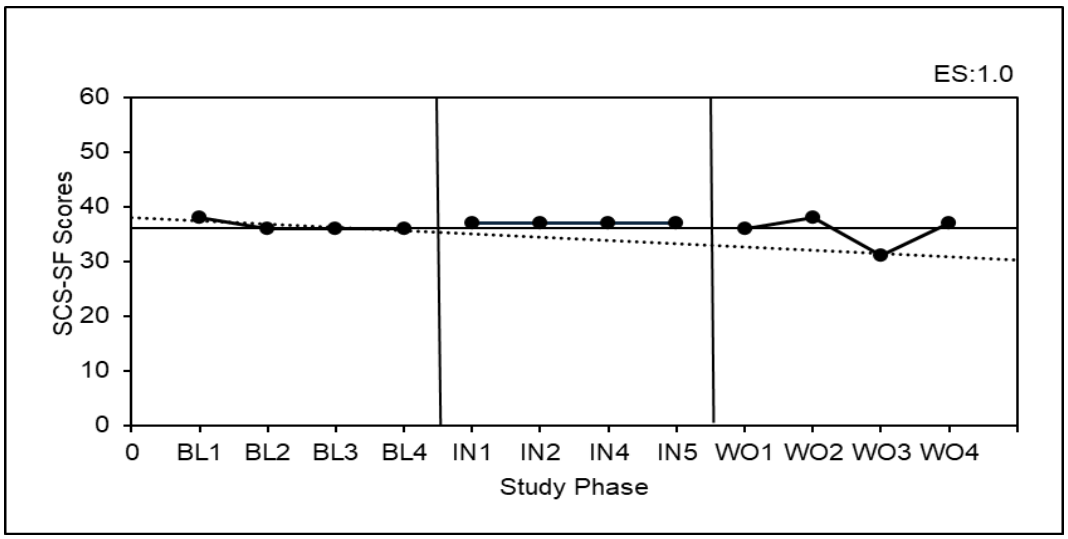




*Figure 11.* Participant Ten graphed time-series data of in-session process measures, baseline median is indicated by a solid line and the trend line is indicated by a dashed line. Solid vertical lines indicate the stages of the study: BL1-4 (baseline), IN1-5 (intervention), and WO1-4 (wash-out). ES: treatment Effect Size; SCS-SF: Self-Compassion Scale Short-Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; Pre: pre-intervention; Mid: midpoint; Post: post-intervention; FU1: follow-up one; FU2: follow-up two.



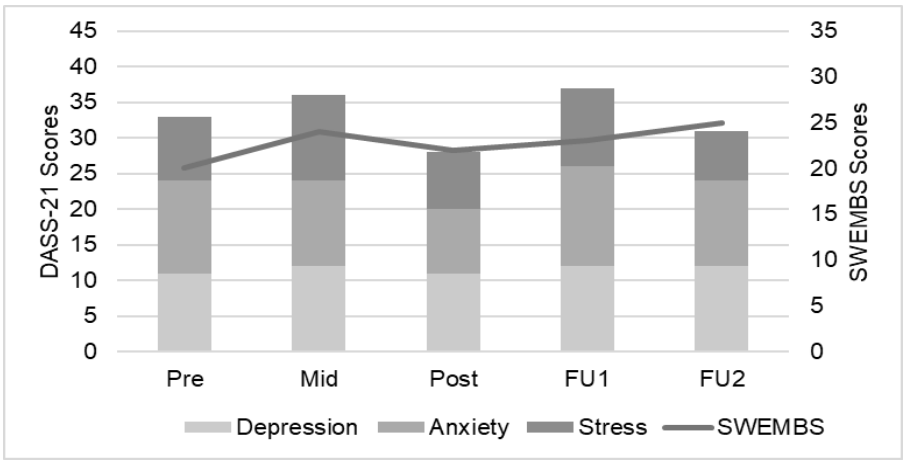
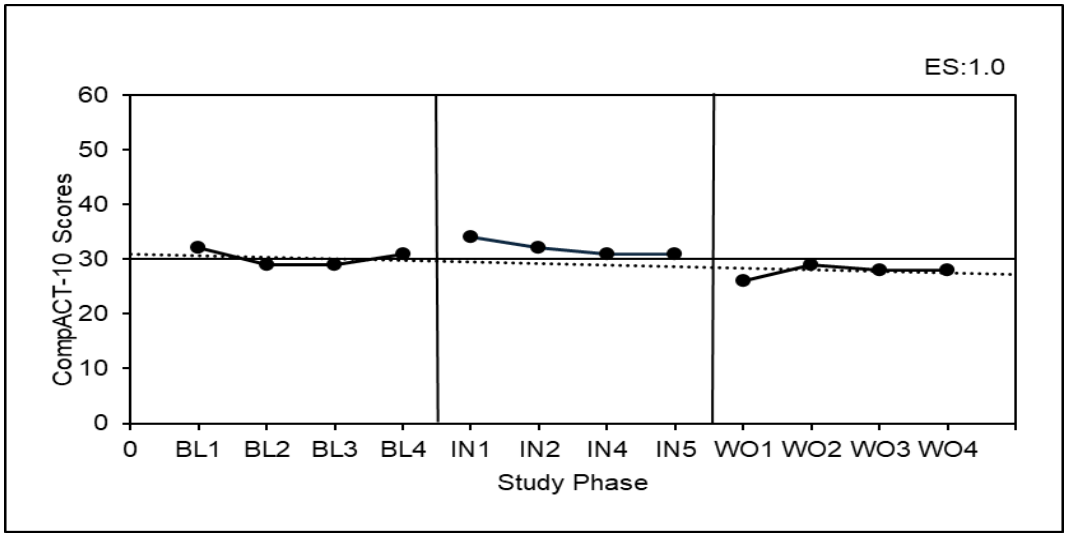
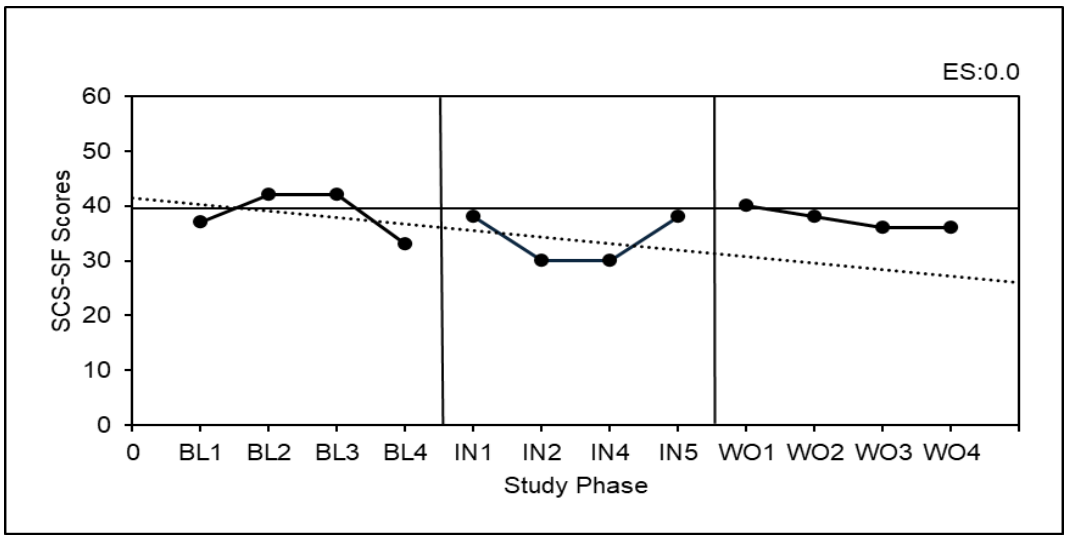




*Figure 12.* Participant Eleven graphed time-series data of in-session process measures, baseline median is indicated by a solid line and the trend line is indicated by a dashed line. Solid vertical lines indicate the stages of the study: BL1-4 (baseline), IN1-5 (intervention), and WO1-4 (wash-out). ES: treatment Effect Size; SCS-SF: Self-Compassion Scale Short-Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; Pre: pre-intervention; Mid: midpoint; Post: post-intervention; FU1: follow-up one; FU2: follow-up two.



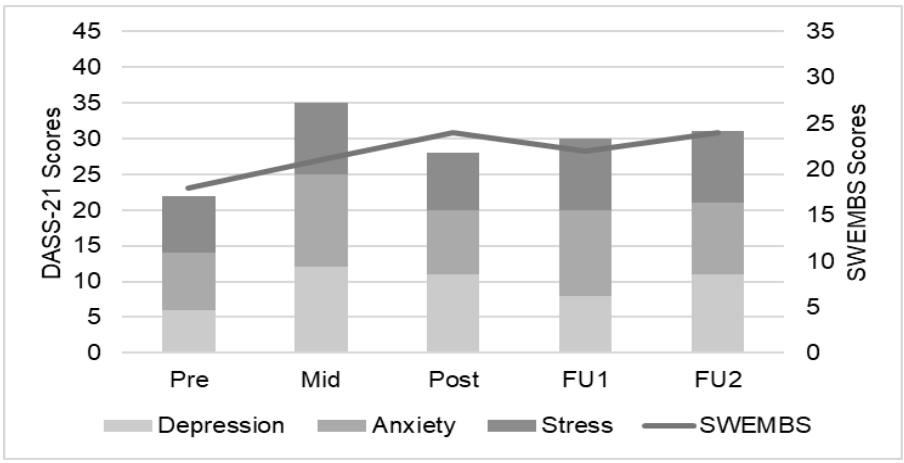




*Figure 13.* Participant Twelve graphed time-series data of in-session process measures, baseline median is indicated by a solid line and the trend line is indicated by a dashed line. Solid vertical lines indicate the stages of the study: BL1-4 (baseline), IN1-5 (intervention), and WO1-4 (wash-out). ES: treatment Effect Size; SCS-SF: Self-Compassion Scale Short-Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; Pre: pre-intervention; Mid: midpoint; Post: post-intervention; FU1: follow-up one; FU2: follow-up two.

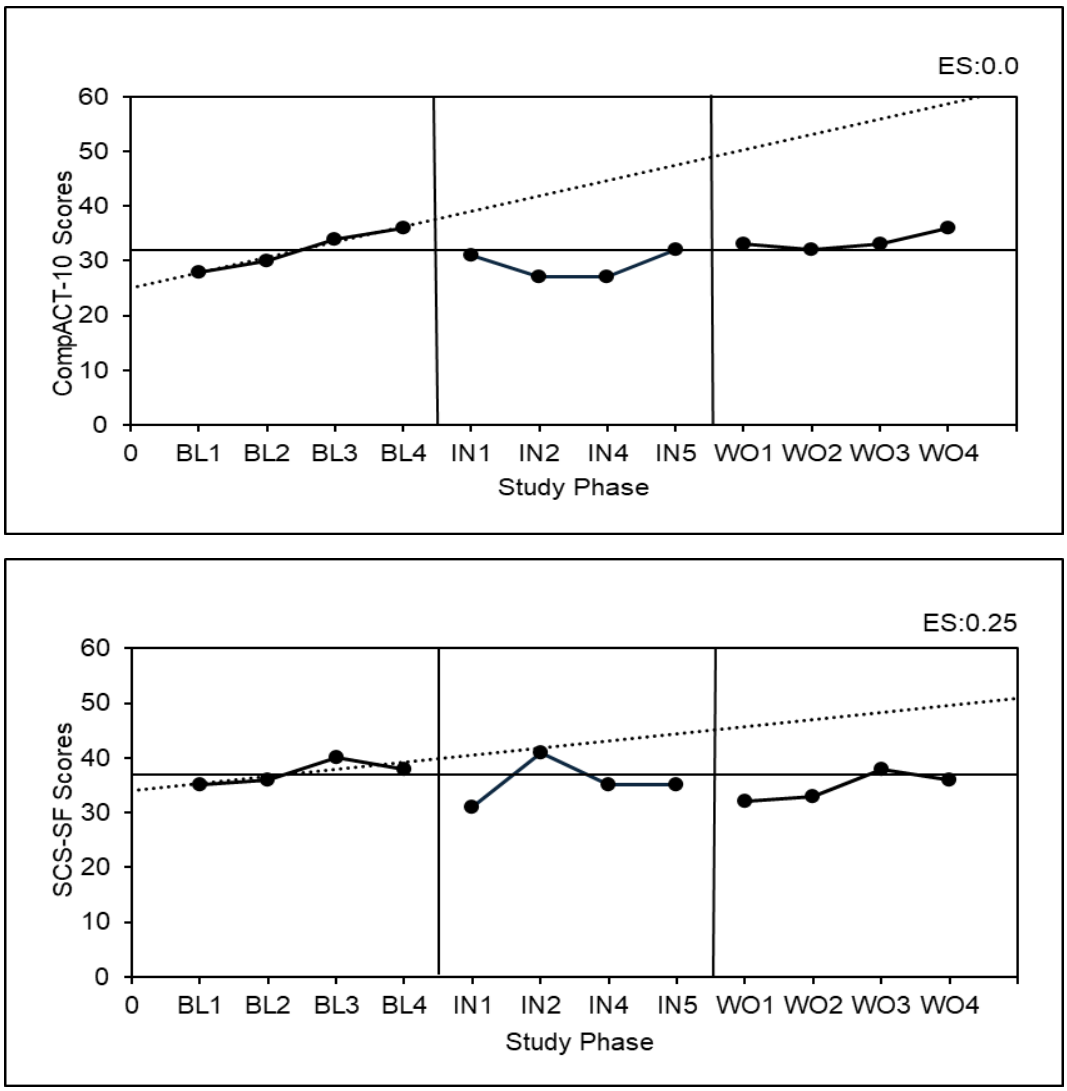
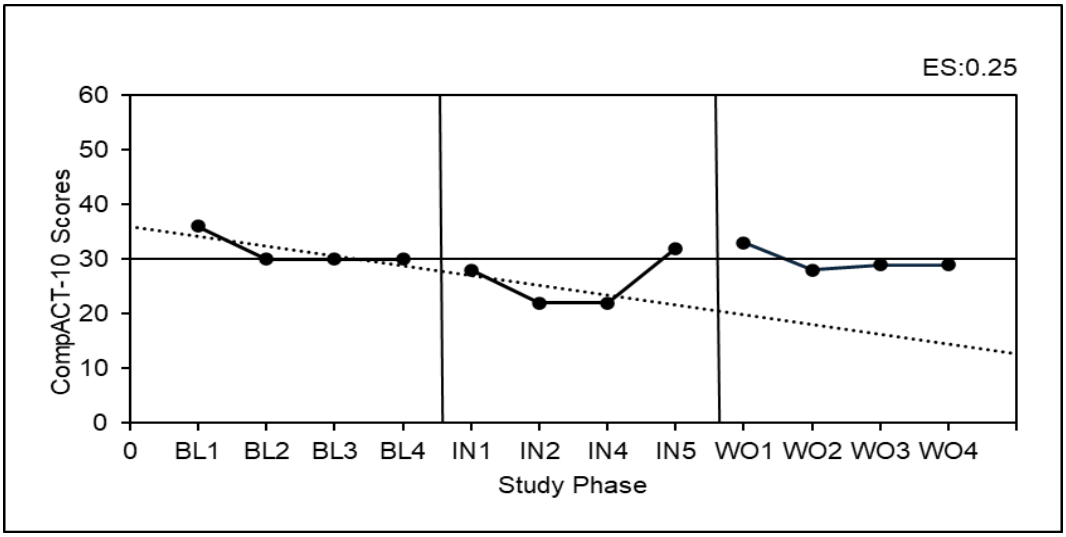
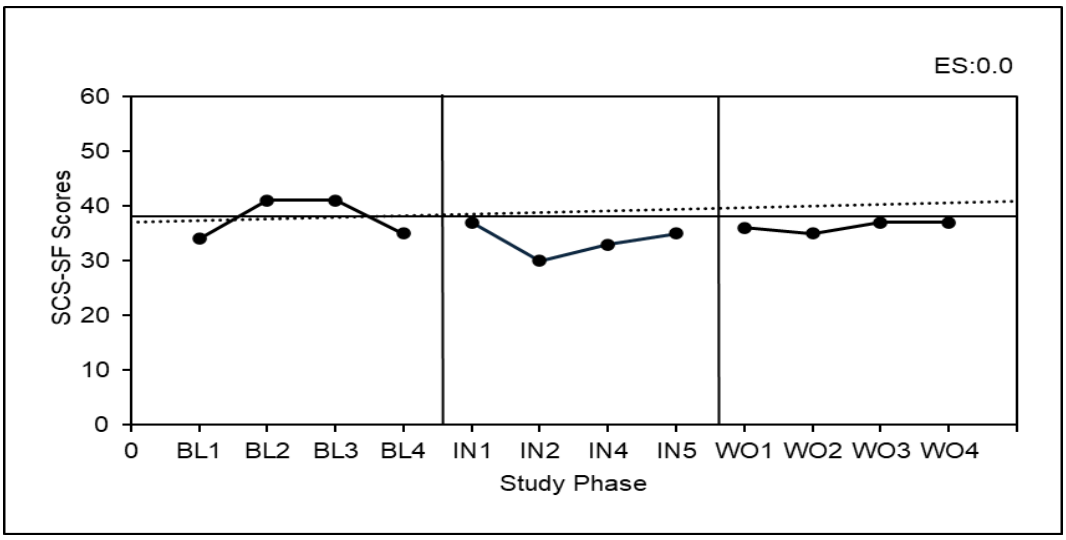



*Figure 14.* Participant Thirteen graphed time-series data of in-session process measures, baseline median is indicated by a solid line and the trend line is indicated by a dashed line. Solid vertical lines indicate the stages of the study: BL1-4 (baseline), IN1-5 (intervention), and WO1-4 (wash-out). ES: treatment Effect Size; SCS-SF: Self-Compassion Scale Short-Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; Pre: pre-intervention; Mid: midpoint; Post: post-intervention; FU1: follow-up one; FU2: follow-up two.



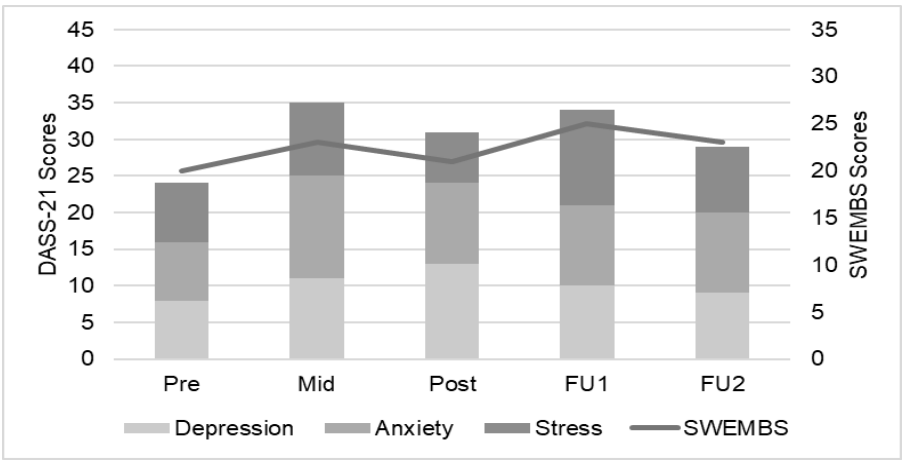




*Figure 15.* Participant Fourteen graphed time-series data of in-session process measures, baseline median is indicated by a solid line and the trend line is indicated by a dashed line. Solid vertical lines indicate the stages of the study: BL1-4 (baseline), IN1-5 (intervention), and WO1-4 (wash-out). ES: treatment Effect Size; SCS-SF: Self-Compassion Scale Short-Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale; Pre: pre-intervention; Mid: midpoint; Post: post-intervention; FU1: follow-up one; FU2: follow-up two.

### *Psychological Distress (DASS-21)*[30]

Across the stages of the study, three participants (21.42%) demonstrated reliable and clinically significant improvements in at least one subscale or overall psychological distress, while six participants (42.85%) experienced reliable and clinically significant deteriorations, and four (28.57%) showed no changes (see Table 4). Interestingly, P8 experienced significant improvements up to the midpoint of the study; however, by the post-intervention point, these gains had reversed, resulting in significantly increased psychological distress. Although P1 and P7 showed a similar trend with reduced distress at the midpoint followed by increases beyond baseline by post-intervention, these changes were not statistically significant.

From the baseline to the post-intervention point, only one participant (P3) experienced reliable positive improvements in overall psychological distress, and no positive changes were observed within the subscales (see Table 5). In contrast, five participants (P2, P9, P13, P14, P8) (35.71%) experienced a reliable and clinically significant worsening, with three of these experiencing this at the post-intervention point and two of the participants' changes occurring during follow-up (See Tables 5 and 6). Nine participants (64.28%) experienced no changes.

In contrast to the hypothesis that yoga would lead to a reduction in psychological distress, just one participant (P3) experienced reliable improvements in psychological distress. These findings suggest that, overall, yoga, as implemented in this study, had limited effectiveness in reducing psychological distress. The significant worsening of symptoms occurred in more than three participants; therefore, the intervention appeared to have an adverse effect on psychological distress within a subset of the sample.

Qualitative data shows that two of the four participants who experienced increased psychological distress (P12, P14) reported personal challenges and barriers of “time” and “interruptions”. In the CCI, all four of the participants who experienced increased psychological distress shared positive psychological

[30] See extended paper section 3.3 (3.3.1-3.3.3) for the findings from the DASS-21 subscales

outcomes from taking part in the intervention. P9, P13 and P14 reported experiencing a subjective reduction in stress; P13 and P14 also reported a perceived reduction in anxiety. P12 reported experiencing “mental improvement” through engaging with yoga. Three of these participants (P9, P13 and P14) also highlighted that yoga was beneficial in alleviating pain, “chronic pain”, “back pain”, and “pain and discomfort”. While not explicitly explored in the study, this may suggest that pain was an underlying issue for some participants, potentially contributing to psychological distress despite perceived benefits from the intervention. The one participant who experienced positive improvements in psychological distress reported having a “good experience”. Although they did not mention any perceived psychological benefits from the study, they reported experiencing “weight loss” through engaging in yoga.

Overall, the yoga intervention demonstrated limited effectiveness in reducing psychological distress. While a small number of participants experienced short-term improvements, these were not sustained, and several participants showed significant worsening over time. Qualitative data provided insight into individual experiences, revealing that even among those whose distress increased, many reported perceived psychological or physical benefits. Barriers to practice, such as time, were only reported by participants whose distress increased, suggesting potential contextual influences on outcomes.

### *Mental Wellbeing (SWEMWBS)*

The yoga intervention had a positive impact on mental wellbeing, with nine participants (64.29%) showing a reliable and clinically significant improvement across the stages of the study (See Table 4). Four participants (28.57%) showed no significant changes, and one participant (7.14%) showed reliable and clinically significant deterioration of mental wellbeing across the stages of the study (P7). Of the nine participants who experienced improved mental wellbeing, seven experienced these improvements during the intervention phase (P1, P5, P8, P10, P11, P12, P13) (77.77%). In contrast, two did not experience positive changes until the follow-up phase (P2, P14) (22.22%) (see Table 4).

Four participants (28.57%) demonstrated reliable increases in mental wellbeing at the post-intervention point (See Table 5). All nine participants who experienced significant positive changes maintained these changes at the final follow-up. In contrast to the majority, P7 experienced a reliable and significant deterioration in mental wellbeing at the final follow-up, but not during the intervention phase, suggesting that these outcomes may not have been directly related to the intervention. Overall, the findings suggest that yoga had a generally positive impact on the mental wellbeing of most participants.

Qualitative data indicate that all nine participants who experienced significant improvements reported a positive experience with the yoga intervention and perceived both physical and mental benefits. Interestingly, in the CCI P7, who experienced a deterioration in mental wellbeing, reported subjective psychological and physical improvements. This contrast between quantitative and qualitative findings suggests that, although P7 experienced a measurable decline in mental wellbeing, they still perceived the intervention as beneficial.

### *Psychological Flexibility (CompACT-10)*

The psychological flexibility baseline data were mixed, with half of the participants showing stability across the four data points. Following the introduction of the yoga intervention, visual analysis indicated varied responses across participants. Five participants showed no changes, six exhibited negative changes, and three showed positive changes. For those who were observed to experience deterioration in psychological flexibility, three of the six participants (P1, P2, P5) met the threshold to determine systematic worsening of psychological flexibility. None of the negative changes that occurred were indicative of reliable change, as determined by RCI calculations. One of the three participants (P3, P8, P11) who showed positive changes in psychological flexibility (P3) experienced changes that met the threshold to be determined as systematic improvements. Despite P11's improvements not meeting the threshold to determine systematic change, their scores reflected that a reliable change had occurred. For P8, the changes were supported by visual analysis and effect size estimates; however, they failed to meet the threshold for a

systematic or reliable change to be determined. The yoga intervention had a limited impact on creating reliable and clinically significant changes in psychological flexibility across the stages of the study (see Table 4). Thirteen participants (92.85%) experienced no reliable changes, and one participant (P11) experienced a reliable improvement in psychological flexibility at the post-intervention point (see Table 5). These findings suggest that yoga, as practised in this study, did not lead to consistent changes in CompACT-10 scores (See Figures 2-15).

These findings are in contrast with the hypothesis that yoga would lead to positive changes in psychological flexibility. In addition to limited positive effects, the yoga intervention may have produced adverse effects for a subset of participants. Given that both improvement and deterioration occurred in three participants, the intervention appears to have functionally variable effects, with evidence of both beneficial and adverse responses across individuals.

In the weekly diary data, none of the participants who experienced reductions in psychological flexibility reported any challenges or barriers to practising yoga. In the CCI, the four participants who experienced deterioration in psychological flexibility shared positive experiences of the yoga intervention, and their responses indicated that they felt it had benefited them. However, in the CCI, P1 expressed that the “time duration should be lesser,” but it was unclear whether they were referring to the class length or the overall study duration. P2 reported experiencing “physical discomfort” while practising yoga. Although P5 and P13 reported reduced pain from yoga, this suggests that they may be managing existing injuries or difficulties related to pain. In the CCI, the three participants who experienced positive changes in psychological flexibility reported experiencing physical and psychological benefits from the intervention.

### *Self-Compassion (SCS-SF)*

The self-compassion baseline data were generally stable, with nine participants showing stability. Visual analysis revealed that the intervention had a limited and, for some, a negative impact on self-compassion. None of the participants were observed to have experienced positive changes, and most experienced no observable changes (71.42%). In contrast to the hypothesis that

yoga would lead to improvements in self-compassion, four participants (P2, P4, P5, P14) (28.57%) were observed to experience reductions following the yoga intervention. Of the four participants who experienced reductions, three (P2, P5, P14) met the threshold to determine systematic deterioration, and two (P4, P14) met the criteria to determine reliable reductions in self-compassion (see Tables 5 and 6).

These findings suggest that yoga, as practised in this study, led to limited changes for most and, contrary to the hypothesis, reductions in self-compassion for some (see Figures 2-15). The yoga intervention in this study had a limited impact on creating reliable and clinically significant changes in self-compassion across the stages of the study (see Table 4), with ten participants showing no change. Four participants (P2, P4, P7, P14) experienced a reliable deterioration across various stages of the study; two of these were observed at the intervention midpoint (P7, P14), one (P4) at post-intervention (see Table 5), and another during the wash-out phase (P2). Given that deterioration in self-compassion occurred in at least three participants, and this pattern was replicated across multiple cases, the intervention appears to have had a functionally adverse effect on self-compassion for some, suggesting that the intervention may not be universally beneficial and could be potentially counterproductive in developing self-compassion for specific individuals.

The weekly diary data showed that one of the four participants who experienced reductions in self-compassion reported a challenge of “interruptions” to engaging in yoga. In the CCI, all the participants reported some perceived positive outcomes from the yoga intervention.

**Table 4**

*Outcome and Process Measure Scores Across the Stages of the Study*

| Participant/ Measure | Process:BLM Outcome:Pre | Process:IN2 Outcome:Mid | Process:IN5 Outcome:Post | Process: WO1 Outcome:FU1 | Process:WO4 Outcome:FU2 |
|---|---|---|---|---|---|
| P1 | | | | | |
| **Process** | | | | | |
| CompACT-10 | 37 | 29 | 34 | 30 | 33 |
| SCS-SF | 36.5 (3.25) | 39 (3.42) | 36 (3.66) | 37 (3.75) | 37 (4.66) |
| **Outcome** | | | | | |
| DASS-21 | 38 | 31 +RC | 40 | 41 | 41 |
| Depression | 15 | 12 | 16 | 15 | 19 |
| Anxiety | 11 | 9 | 12 | 12 | 12 |
| Stress | 12 | 10 | 12 | 14 | 10 |
| SWEMWBS | 21 | 26 +RC | 24 | 23 | 25 +RC |
| P2 | | | | | |
| **Process** | | | | | |
| CompACT-10 | 33.5 | 24 | 32 | 29 | 30 |
| SCS-SF | 40 (3.16) | 37 (3.75) | 32 (3.75) | 32 (3.83)-R | 38 (3.5) |
| **Outcome** | | | | | |
| DASS-21 | 37 | 38 | 34 | 38 | 45-RC |
| Depression | 10 | 16 -RC | 15 | 15 | 16-RC |
| Anxiety | 14 | 11 | 10 | 12 | 16 |
| Stress | 13 | 11 | 9 | 11 | 13 |
| SWEMWBS | 22 | 24 | 24 | 25 | 27+RC |
| P3 | | | | | |
| **Process** | | | | | |
| CompACT-10 | 25.5 | 28 | 29 | 32 | 28 |
| SCS-SF | 40 (3.66) | 36 (3.66) | 36 (3.33) | 38 (3.83) | 38 (3.66) |
| **Outcome** | | | | | |
| DASS-21 | 42 | 43 | 34+RC | 39 | 43 |
| Depression | 17 | 15 | 14 | 14 | 14 |
| Anxiety | 12 | 14 | 11 | 12 | 15 |
| Stress | 13 | 14 | 9 | 13 | 14 |
| SWEMWBS | 22 | 24 | 23 | 22 | 25 |

| Participant/ Measure | Process:BLM Outcome:Pre | Process:IN2 Outcome:Mid | Process:IN5 Outcome:Post | Process: WO1 Outcome:FU1 | Process:WO4 Outcome:FU2 |
|---|---|---|---|---|---|
| P4 | | | | | |
| **Process** | | | | | |
| CompACT-10 | 30 | 31 | 35 | 26 | 29 |
| SCS-SF | 37.5 (3.66) | 34 (4.08) | 27-R (3.42) | 42 (3.5) | 33 (4.08) |
| **Outcome** | | | | | |
| DASS-21 | 39 | 37 | 32 | 40 | 41 |
| Depression | 15 | 13 | 10 | 14 | 16 |
| Anxiety | 12 | 11 | 10 | 14 | 14 |
| Stress | 12 | 13 | 12 | 12 | 11 |
| SWEMBS | 23 | 23 | 24 | 22 | 24 |
| P5 | | | | | |
| **Process** | | | | | |
| CompACT-10 | 36.5 | 28 | 28 | 40 | 27 |
| SCS-SF | 39.5 (3.08) | 33 (3.33) | 39 (3.25) | 35 (3.75) | 34 (3.16) |
| **Outcome** | | | | | |
| DASS-21 | 38 | 43 | 37 | 35 | 36 |
| Depression | 12 | 16 | 11 | 11 | 11 |
| Anxiety | 11 | 15 | 16 | 13 | 13 |
| Stress | 15 | 12 | 10 | 11 | 12 |
| SWEMWBS | 21 | 26 +RC | 24 | 23 | 26 +RC |
| P6 | | | | | |
| **Process** | | | | | |
| CompACT-10 | 33.5 | 34 | 32 | 24 | 42 |
| SCS-SF | 34.5 (3.42) | 37 (3.16) | 36 (3.66) | 33 (3.41) | 33 (3.41) |
| **Outcome** | | | | | |
| DASS-21 | 39 | 38 | 38 | 37 | 41 |
| Depression | 12 | 11 | 16 | 13 | 13 |
| Anxiety | 16 | 13 | 14 | 11 | 11 |
| Stress | 11 | 14 | 8 | 13 | 17-RC |
| SWEMWBS | 23 | 25 | 25 | 26 | 23 |

| Participant/ Measure | Process:BLM Outcome:Pre | Process:IN2 Outcome:Mid | Process:IN5 Outcome:Post | Process: WO1 Outcome:FU1 | Process:WO4 Outcome:FU2 |
|---|---|---|---|---|---|
| P7 | | | | | |
| **Process** | | | | | |
| CompACT-10 | 25 | 25 | 23 | 26 | 28 |
| SCS-SF | 36 (3.92) | 28(3.83) | 33 (3.5) | 35 (3.41) | 38 (3.83) |
| **Outcome** | | | | | |
| DASS-21 | 36 | 15+RC | 41 | 37 | 40 |
| Depression | 14 | 6+RC | 12 | 13 | 16 |
| Anxiety | 11 | 4+RC | 16 | 11 | 10 |
| Stress | 11 | 5+RC | 13 | 13 | 14 |
| SWEMWBS | 27 | 29 | 25 | 26 | 22 -R |
| P8 | | | | | |
| **Process** | | | | | |
| CompACT-10 | 24 | 30 | 29 | 35 | 23 |
| SCS-SF | 34 (3.83) | 32 (3.16) | 38 (3.83) | 37 (4.25) | 38 (4) |
| **Outcome** | | | | | |
| DASS-21 | 35 | 18+RC | 40 | 41-RC | 41-RC |
| Depression | 11 | 3+RC | 12 | 14 | 13 |
| Anxiety | 13 | 6+RC | 15 | 15 | 11 |
| Stress | 11 | 9 | 13 | 12 | 17-RC |
| SWEMBS | 20 | 30+RC | 26+RC | 28+RC | 27+RC |
| P9 | | | | | |
| **Process** | | | | | |
| CompACT-10 | 27 | 27 | 26 | 29 | 34 |
| SCS-SF | 37 (3.75) | 37 (3.91) | 34 (4.03) | 39 (4.08) | 33 (3.33) |
| **Outcome** | | | | | |
| DASS-21 | 32 | 44-RC | 38-RC | 42-RC | 33 |
| Depression | 13 | 16 | 11 | 13 | 10 |
| Anxiety | 10 | 14 | 14 | 13 | 10 |
| Stress | 9 | 14-RC | 13 | 16-RC | 13 |
| SWEMWBS | 27 | 26 | 27 | 30 | 28 |

| Participant/ Measure | Process:BLM Outcome:Pre | Process:IN2 Outcome:Mid | Process:IN5 Outcome:Post | Process: WO1 Outcome:FU1 | Process:WO4 Outcome:FU2 |
|---|---|---|---|---|---|
| P10 | | | | | |
| **Process** | | | | | |
| CompACT-10 | 30 | 30 | 39 | 29 | 31 |
| SCS-SF | 35 (2.75) | 36 (3.08) | 31 (2.58) | 36 (3.16) | 33 (3.33) |
| **Outcome** | | | | | |
| DASS-21 | 31 | 33 | 30 | 32 | 31 |
| Depression | 12 | 11 | 12 | 13 | 12 |
| Anxiety | 9 | 11 | 10 | 9 | 10 |
| Stress | 10 | 11 | 8 | 10 | 9 |
| SWEMWBS | 17 | 22+RC | 22+RC | 22+RC | 26+RC |
| P11 | | | | | |
| **Process** | | | | | |
| CompACT-10 | 24 | 33 | 36+RC | 30 | 28 |
| SCS-SF | 36 (3.33) | 37 (3.08) | 37 (3.08) | 36 (3.33) | 37 (3.08) |
| **Outcome** | | | | | |
| DASS-21 | 33 | 36 | 28 | 37 | 31 |
| Depression | 11 | 12 | 11 | 12 | 12 |
| Anxiety | 13 | 12 | 9 | 14 | 12 |
| Stress | 9 | 12 | 8 | 11 | 7 |
| SWEMWBS | 20 | 24+RC | 22 | 23 | 25+RC |
| P12 | | | | | |
| **Process** | | | | | |
| CompACT-10 | 30 | 32 | 31 | 26 | 28 |
| SCS-SF | 39.5 (2.75) | 30 (3.08) | 38 (2.83) | 40 (3.5) | 36 (3) |
| **Outcome** | | | | | |
| DASS-21 | 22 | 35-RC | 28-RC | 30-RC | 31-RC |
| Depression | 6 | 12-RC | 11 | 8 | 11 |
| Anxiety | 8 | 13 | 9 | 12 | 10 |
| Stress | 8 | 10 | 8 | 10 | 10 |
| SWEMBS | 18 | 21 | 24+RC | 22+RC | 24+RC |

| Participant/ Measure | Process:BLM Outcome:Pre | Process:IN2 Outcome:Mid | Process:IN5 Outcome:Post | Process: WO1 Outcome:FU1 | Process:WO4 Outcome:FU2 |
|---|---|---|---|---|---|
| P13 | | | | | |
| **Process** | | | | | |
| CompACT-10 | 32 | 27 | 32 | 33 | 36 |
| SCS-SF | 37 (2.92) | 41 (3) | 35 (3.03) | 32 (3.5) | 36 (3.33) |
| **Outcome** | | | | | |
| DASS-21 | 24 | 31-RC | 32 -RC | 34-RC | 37-RC |
| Depression | 8 | 12 | 13 | 10 | 12 |
| Anxiety | 8 | 9 | 11 | 11 | 11 |
| Stress | 8 | 10 | 8 | 13 | 14-RC |
| SWEMWBS | 19 | 25+RC | 25+RC | 25+RC | 27+RC |
| P14 | | | | | |
| **Process** | | | | | |
| CompACT-10 | 30 | 22 | 32 | 33 | 29 |
| SCS-SF | 38 (2.83) | 30-RC(3.58) | 35 (3.08) | 36 (3.16) | 37 (3.33) |
| **Outcome** | | | | | |
| DASS-21 | 23 | 35-RC | 31-RC | 34-RC | 29-RC |
| Depression | 9 | 11 | 13 | 10 | 9 |
| Anxiety | 8 | 14-RC | 11 | 11 | 11 |
| Stress | 6 | 10 | 7 | 13-RC | 9 |
| SWEMWBS | 20 | 23 | 21 | 25+RC | 23 |

*Note.* Process: Process Measures; Outcome: Outcome Measures; BLM: Baseline Median; IN2: Intervention week 2; Mid: midpoint; IN5: Intervention week 5; Post: post-intervention; WO1: Washout week 1; FU1: Follow-up week 1; WO4: Washout week 4; FU2: Follow-up week 2. CompACT-10: higher scores indicate greater Psychological Flexibility; SCS-SF: Self-Compassion Scale-Short Form, higher scores indicate greater self-compassion, totalled means of the six subscales displayed in brackets; DASS-21: Depression Anxiety Stress Scale-21, higher scores indicate greater psychological distress; SWEMWBS: Short Warwick-Edinburgh Mental Wellbeing Scale, higher scores indicate better mental wellbeing.

+R= Reliable Improvement, +RC= Reliable and Clinically Significant Improvement (from clinical to non-clinical range. -R, Reliable Deterioration, -RC Reliable and Clinically Significant Deterioration.

**Table 5**

*Reliable and Clinically Significant Change from Baseline to Post-Intervention*

| PP | Mean weekly practice | CompACT-10 | SCS-SF | DASS-21 | Depression | Anxiety | Stress | SWEMWBS |
|---|---|---|---|---|---|---|---|---|
| P1 | 4.16 | X | X | X | X | X | X | X |
| P2 | 3.33 | X | X | X | X | X | X | X |
| P3 | 4 | X | X | √ | X | X | X | X |
| P4 | 3 | X | - | X | X | X | X | X |
| P5 | 3.5 | X | X | X | X | X | X | X |
| P6 | 3 | X | X | X | X | X | X | X |
| P7 | 4.33 | X | X | X | X | X | X | X |
| P8 | 5.33 | X | X | X | X | X | X | √ |
| P9 | 4 | X | X | - | X | X | X | X |
| P10 | 3.5 | X | X | X | X | X | X | √ |
| P11 | 3.83 | √ | X | X | X | X | X | X |
| P12 | 3.5 | X | X | - | X | X | X | √ |
| P13 | 3 | X | X | - | X | X | X | √ |
| P14 | 3.5 | X | X | - | X | X | X | X |

*Note.* PP: Participant; CompACT-10: Measure of Psychological Flexibility; SCS-SF: Self-Compassion Scale-Short Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental wellbeing Scale.

X: No change; √: Reliable and Clinically Significant Change; - : Reliable Deterioration

### *Weekly Diary*

All participants completed a weekly diary in which they were asked if they experienced any barriers or personal challenges while practising yoga. Most participants (78.57%) reported no barriers or challenges; however, three participants (21.43%) identified challenges, including illness, time constraints, and interruptions, as well as barriers such as distractions and noise.

### *Frequency of Practice*

Overall, the mean frequency of yoga practice was 3.7 times per week, with a range of 3-5.33 times per week. Participants were divided into groups based on their completion rates to compare the impact of practice frequency on outcomes.

Of the six participants (42.85%) in the above-average completion group, two participants (P9 and P7) (14.28%) had demonstrated limited or negative changes in response to the intervention. In contrast, four participants (28.57%) experienced mixed outcomes, demonstrating positive changes in some areas and negative changes in others.

Of the eight participants in the below-average completion group, one participant (P10) (7.14%) exhibited no changes in most areas and an improvement in mental wellbeing (P10), and two participants (P4 and P6) (14.28%) experienced limited or negative changes in response to the intervention. Five participants (35.71%) experienced mixed outcomes, characterised by positive changes in mental wellbeing but negative changes in other areas. There was no clear or consistent relationship between frequency of practice and overall outcomes. Both the above-average and below-average practice groups included participants with mixed results, including positive changes in some domains and deterioration in others. Notably, even among those who practised more frequently, some experienced increased psychological distress or declines in other measures, suggesting that more practice alone did not reliably predict more favourable outcomes.

### *Narrative of the Client Change Interview*[31]

Overall, participants reported a positive experience of the yoga intervention, citing a wide range of physical and emotional benefits. Eight participants (57.14%) reported experiencing both physical and emotional benefits from the practice. A further four participants (28.57%) reported only physical benefits from the practice, including increased endurance, improved

[31] See extended paper section 3.4 for a more detailed account of the CCI and see table 11 for details of participant responses to the questions.

strength and flexibility, better posture, and pain relief. One participant (7.14%) highlighted only emotional benefits (P8). Many attributed these changes to consistent yoga practice, with others linking them to specific aspects of yoga such as posture, breathing, or improved physical capacity. Six participants raised challenges, which included the risk of injury (21.43%) and experiencing discomfort (21.43%). Despite these challenges, all the participants described their involvement in the study as a positive experience (see Table 11).

## Discussion

This study explored whether: (1) a six-week online yoga intervention is effective in reducing psychological distress and improving mental wellbeing among students; and (2) whether psychological flexibility and self-compassion function as MOC that underpin positive outcomes. Despite an established body of literature highlighting the psychological benefits of yoga (Brinsley et al., 2021), findings from this SCED revealed a mixed pattern of effects. While mental wellbeing improved for most participants, psychological distress often showed little change or deterioration, psychological flexibility outcomes included both improvements and deteriorations, and self-compassion remained stable for most but showed deterioration in four cases. These results raise important questions about the contextual, individual, and cultural factors influencing the effectiveness of yoga-based interventions.

### Effectiveness of the Online Yoga Intervention

It was hypothesised that the yoga intervention would lead to a reduction in psychological distress and an improvement in mental wellbeing. However, the quantitative data indicated that psychological distress did not consistently improve and, for some participants, worsened. Across the stages of the study, reliable and clinically significant worsening of psychological distress was observed in a subset of participants. Reliable improvement at the post-intervention stage was rare, occurring in only one participant. This is inconsistent with previous studies demonstrating yoga's efficacy in reducing psychological distress across various populations (Brinsley et al., 2021; Pascoe & Bauer, 2015). In contrast, mental wellbeing exhibited a clearer pattern of positive change, with four participants experiencing reliable and clinically

significant improvements at the post-intervention stage, and no cases of deterioration during the intervention phase. Across the study phases, nine participants showed overall improvement, including seven who demonstrated reliable and clinically significant improvements at mid or post-intervention, and a further two whose improvements emerged later. The only decline in wellbeing occurred at follow-up, suggesting it may have been unrelated to the intervention itself.[32]

This pattern suggests several possibilities. First, the heightened self-awareness cultivated through yoga (Parkinson & Smith, 2023) may have led participants to become more aware of their existing distress, increasing symptom reporting (Mehling et al., 2009). Second, behavioural activation through physical engagement, consistent with ACT principles, may have contributed to subjective improvements in wellbeing despite persistent symptoms of psychological distress (Hayes et al., 2006). Lastly, the qualitative data highlighted some adverse effects of engaging in yoga practice. Five participants reported pain, discomfort and physical challenges associated with practising yoga within the study. Two of these participants experienced reductions in psychological flexibility and increased distress; three experienced reductions in self-compassion. Despite this, two of the three also experienced improved mental wellbeing. These findings are consistent with previous reviews documenting that yoga, while generally safe, can lead to adverse effects such as pain and exacerbation of symptoms (Cramer et al., 2019).

From an ACT perspective, this separation of psychological distress and mental wellbeing is not entirely unexpected. Psychological flexibility theory (Kashdan & Rottenberg, 2010; Hayes et al., 2006) suggests that mental health is not merely the absence of symptoms, but rather the ability to continue moving towards valued goals while allowing space for uncomfortable internal experiences. From this perspective, wellbeing can improve even when distress is present, as long as individuals continue to engage in meaningful activities that align with their values. In this study, it is possible that the yoga intervention was perceived as a meaningful self-care activity, which may have contributed to

[32] See extended paper section 4.1 for more information on the intervention effectiveness.

greater mental wellbeing by promoting movement towards a valued action, such as self-care, without alleviating symptoms of distress. However, in contrast to some ACT-based studies, the wellbeing improvements observed in this study did not appear to be mediated by corresponding increases in psychological flexibility (Grégoire et al., 2020; Ong et al., 2024; Wersebe et al., 2018).[33]

**Psychological Flexibility and Self-Compassion as MOC**

It was hypothesised that the yoga intervention would lead to increases in psychological flexibility and self-compassion, which in turn would underpin improvements in psychological distress and mental wellbeing. This hypothesis was grounded in ACT theory (Hayes et al., 2006), which proposes psychological flexibility as a core therapeutic process central to mental wellbeing, and the CFT model (Gilbert, 2009), which conceptualises self-compassion as a powerful buffer against psychological distress. Together, these processes are theorised to enable individuals to respond more constructively to difficult internal experiences, thereby enhancing wellbeing (Bennetts, 2022; Kishida et al., 2019). While research has supported the utility of yoga in improving psychological flexibility (Avery et al., 2018; Fox et al., 2024) and self-compassion (Gard et al., 2012; Riley & Park, 2015), the current study found a mixed pattern for psychological flexibility and a predominantly negative pattern for self-compassion.

The overall absence of broad, reliable, and systematic improvement in psychological flexibility, along with the consistent lack of improvement and replicated deterioration in self-compassion, suggests that these processes did not consistently function as MOC in the current study. Several factors may account for this discrepancy with the existing literature. Fox et al. (2024) found that psychological flexibility was most strongly associated with ethical guidance on personal conduct *(yama)* and physical postures *(asana)*, with smaller associations to the other limbs of yoga. The current intervention emphasised only four limbs: physical postures *(asana),* breath control *(pranayama),* concentration *(dharana),* and meditation *(dhyana),* without direct inclusion of ethical guidance, which may partly explain the absence of consistent gains in

[33] See extended paper section 4.2 for a discussion of the findings in relation to ACT theory.

psychological flexibility**.** However, the Fox et al. (2024) study was cross-sectional and did not control for the type of yoga practised. It remains unclear to what extent participants were engaging with all eight limbs of yoga, as this is relatively uncommon in Western practice (Govindaraj et al., 2016).[34]

In addition, previous studies reporting positive changes in these mechanisms have typically involved longer interventions, greater integration of yoga philosophy, and opportunities to apply skills to everyday life (Avery et al., 2018; Dick et al., 2015; Gard et al., 2014). These elements may have extended the intervention effect, and the absence of these components in the current intervention may have limited participants' cognitive and emotional engagement, limiting positive changes in psychological flexibility and self-compassion.

A further consideration is the sensitivity of the Reliable Change Index (RCI), which is used to evaluate individual-level outcomes (Jacobson & Truax, 1991). As this method requires changes significant enough to exceed measurement error, it often establishes high thresholds to avoid false positives. However, it has been argued that the RCI may be overly conservative, risking the failure to capture modest yet meaningful improvements (McAleavey, 2024; Wise, 2004). In the current study, this limitation may partly explain the lack of reliable change observed on the measures, as subtle shifts in psychological flexibility and self-compassion could have remained undetected using this method. However, additional methods were supplemented to strengthen the ability to detect an effect in this study.

The observed heterogeneity in individual outcomes also warrants attention. Some participants demonstrated improvement, while others showed deterioration, and many experienced no change, suggesting that individual differences may have played a stronger role in outcomes than the yoga intervention. This finding is consistent with a systematic review of 16 studies, which reported that yoga practice was associated with improved quality of life and life satisfaction, but also with increased levels of distress and physical impairment in some individuals (Park et al., 2015). Park et al. (2015) emphasised that the benefits of yoga are not universally experienced and may

[34] See extended paper section 4.3 for a discussion of the findings in relation to MOC research.

depend on personal relevance, prior expectations, and psychosocial context, as well as possible selection effects.

### Discrepancies of Qualitative and Quantitative Findings

Interestingly, the qualitative feedback revealed that most participants reported a positive experience with the intervention and identified both physical and psychological benefits. This incongruence highlights the complexity of interpreting outcomes in psychological research and underscores the value of integrating qualitative data (Hitchcock et al., 2010). While quantitative measures failed to detect significant or systematic improvements in psychological distress, participant narratives described a reduction in stress and anxiety, improved sleep, enhanced emotional regulation, better posture, and flexibility. For example, several noted that specific elements of the yoga intervention, such as breathwork and holding postures, were particularly helpful in reducing anxiety or improving mood.[35]

### Cultural and Gender Considerations

A distinctive strength of this study is its inclusion of participants who are usually underrepresented in yoga research. The sample was predominantly male (64.29%) and included a high proportion of participants from racially minoritised backgrounds (71.43%). This stands in stark contrast to much of the existing literature, including Fox et al. (2024), where the majority of participants were white women, reflecting the demographic bias of middle-class, western women in yoga research (Cartwright et al., 2020; Park et al., 2015). The demographic differences of the participants in the current study may partially explain the difference in findings from the established literature. Cultural perceptions of yoga, gender norms, and historical exclusion from wellness spaces could shape engagement, interpretation, and receptivity to yoga (Cagas et al., 2021; McIver et al., 2021; Spadola et al., 2017). For instance, men from racially minoritised backgrounds may experience yoga differently due to masculinity norms, unfamiliarity with the practice, or perceived incongruence with their cultural identity (Cagas et al., 2024; Strings et al., 2019). This

[35] See extended paper section 4.4 for a further discussion of the discrepancies between qualitative and quantitative findings.

highlights the need for culturally adapted and gender-sensitive yoga interventions that resonate with racially minoritised men.

Importantly, however, the high completion rate among men from racially minoritised backgrounds indicates that the intervention was both feasible and acceptable for this group. Rather than pointing to a problem with the intervention, the findings suggest that contextual and demographic factors strongly influence how yoga is experienced and reported. This challenges the assumption that yoga predominantly appeals to women (Cagas et al., 2024; Strings et al., 2019) and suggests that when offered in accessible formats, yoga can engage underrepresented groups, although the outcomes may not align with findings from culturally homogeneous samples. Future research should explore how yoga is interpreted and experienced in different cultural contexts, particularly among racially minoritised groups where little literature exists (Middleton et al., 2017).[36]

**Limitations**

Although the research provides insight into how underrepresented populations experience yoga as an intervention, several limitations should be acknowledged. Firstly, the SCED design inherently limits the generalisability. While SCED allows for detailed within-person analyses and sensitivity to individual variability, the smaller sample size and lack of randomisation mean that findings cannot be reliably extended to broader populations (Kazdin, 2019). However, in this study, participants showed differential outcomes which may have been linked to personal, contextual or situational factors, suggesting that the outcomes were highly individualised which provides support for the SCED approach.

Secondly, there were missing data for the process measures (psychological flexibility and self-compassion) at both the midpoint and end of the intervention. This limited the ability to examine the hypothesised MOC over time and to track temporal patterns of change, weakening the causal inferences that can be drawn about the impact of the intervention (Kratochwill et al., 2010).

[36] See extended paper section 4.5 for further discussion of the findings in relation to culture and gender.

Thirdly, the study relied entirely on self-report measures, which are vulnerable to response biases, social desirability effects, and the influence of current emotional states (Paulhus & Vazire, 2007). Objective behavioural or physiological measures might have offered a more robust and nuanced picture of intervention effects. In the present study, psychological distress and mental wellbeing were conceptualised as related but distinct constructs, with distress reflecting the presence of negative psychological symptoms, and wellbeing reflecting positive emotional functioning and subjective vitality.

Fourthly, the intervention was delivered remotely using a pre-recorded yoga programme, which meant participants did not have access to real-time support, opportunities for individualised adaptations, and communication with the instructor. This may have reduced the ability to respond to participants' physical or psychological needs during the intervention and has implications for safeguarding participant wellbeing. Future research incorporating live or interactive delivery formats may enhance responsiveness, safety, and participant support.

Finally, the lack of a structured qualitative interview post-intervention limited the understanding of the outcomes and the discrepancy between the qualitative and quantitative data. This discrepancy may partly reflect the differential sensitivity of standardised distress measures versus wellbeing indicators to the types of changes facilitated by yoga.

A more structured and in-depth process of gathering qualitative data may have facilitated a better understanding of the outcomes and allowed participants to share more information regarding their perceptions and experiences of the intervention. Despite these limitations, the SCED design allowed for detailed within-person analysis and demonstrated the feasibility of delivering online yoga to diverse student populations. The findings raise critical questions for future research on tailoring wellness practices to better accommodate cultural, gendered, and contextual needs.[37]

**Clinical and Future Research Implications**

[37] See extended paper section 4.6 for a further discussion of the research limitations.

The findings offer several implications for practice and research. Clinicians should be cautious when recommending yoga for distress reduction, as it may not benefit all individuals equally and could exacerbate symptoms in some. A more personalised approach, considering physical limitations, cultural background, gender, and individual preferences, may enhance efficacy. Mental health practitioners who incorporate yoga into treatment plans should ensure that they provide appropriate support and tailor it accordingly.

From a research perspective, the study emphasises the importance of recruiting participants from diverse backgrounds and examining the cultural influences on intervention outcomes. Future studies could explore in more depth the impacts of yoga on the physical and mental health of men from racially marginalised backgrounds. Additionally, combining quantitative and qualitative methods, particularly in-depth qualitative interviews, would allow researchers to capture more nuanced insights into how participants engage with and make sense of interventions.

A key finding was the discrepancy between distress reported on standardised measures and participants' qualitative accounts of improved wellbeing. This supports the distinction between distress reduction and wellbeing enhancement, suggesting that yoga may primarily influence positive emotional states without necessarily reducing distress symptoms in the short term. This suggests that existing measures may not fully capture the kinds of changes yoga facilitates. Future studies could include focus groups or objective outcome measures at the end of interventions to explore these differences in greater depth.

In relation to the exploration of MOC in yoga, the current study's findings did not identify any positive changes in psychological distress or related changes in psychological flexibility or self-compassion. There is a need for future research to provide clearer insights into the MOC that occur in yoga, and how these might differ across cultures or genders.[38]

[38] See extended paper section 4.7 for a further discussion of the clinical and research implications.

## Conclusion

In summary, this study challenges the assumption that yoga universally benefits mental health. The six-week online yoga intervention did not result in consistent improvements in psychological flexibility, self-compassion, or psychological distress; however, most participants reported improvements in mental wellbeing. These findings highlight the importance of distinguishing between distress reduction and wellbeing enhancement when evaluating mind–body interventions and suggest that yoga's psychological impact may be more individualised and context-dependent than previously understood. Notably, the study engaged a diverse sample who are underrepresented in yoga research. The high retention and completion rates indicate that online yoga interventions are both feasible and acceptable for this group, demonstrating the potential to engage populations often excluded from yoga research**.** While yoga holds potential for enhancing wellbeing, its role in reducing distress appears more complex, highlighting the importance of tailoring interventions to individual needs.[39]

**Word count: 7972**

[39] See extended paper section 5 for a personal critical reflection of the research.

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# Appendices

## Appendix A

*International Journal of Wellbeing Submission Guidelines*

### Submission Preparation Checklist

As part of the submission process, authors are required to check off their submission's compliance with all of the following items, and submissions may be returned to authors that do not adhere to these guidelines.

- The submission file is in OpenOffice, Microsoft Word, or RTF document file format.
- Where available, URLs and DOIs for the references have been provided.
- An abstract of about 200 to 300 words is included at the beginning of your submission. Book reviews need abstracts too (of about 100 words).
- The text adheres to the stylistic and bibliographic requirements outlined in the Author Guidelines below.
- If submitting to a peer-reviewed section of the journal, the instructions in ensuring a blind review have been followed.
- The submission is the work of the named authors who have all agreed to submit (all authors have been included in the submission), has not been previously published, nor is it before another journal for consideration (or an explanation has been provided in Comments to the Editor).
- In the comments for the editor, 5 suggested reviewers have been identified and their emails have been provided. These suggested reviewers are experts in the field and there this no conflict of interest with any of them (i.e., these individuals are not familiar with the project submitted for review, are not from the same institution as any of the authors, and are not present or past advisors, advisees, or collaborators

of any of the authors.) Please note many leaders of various feilds do not have capacity to review many journal articles (i.e., less likely to agree), we also suggest focusing on individuals who have published in the same area within the last 5 years.

- AI: If artificial intelligence has been used in any part of the research or drafting of your submission, please make sure this is accurately acknowledged at the end of your manuscript.

**Author Guidelines**

**There are no fees for authors or readers.**

**All articles** will preferably be up to 8,000 words (not including references and tables), but longer articles will be considered if written concisely. The text should be double-spaced; use an easy-reading 12-point font (such as Times New Roman); sparingly employ *italics*, rather than underlining for emphasis (except with URL addresses); and all illustrations, figures, and tables should be placed within the text at the appropriate points, rather than at the end.

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All articles should use internally **consistent spelling, grammar, and language** (American and British English will both be accepted). Please also restrict the use of Latin phrases, long sentences, and overly-technical writing as much as possible.

**Referencing** should follow any one of the major referencing formats (APA, Chicago author-date or footnote, etc.). Please see existing articles for examples. If using APA, please refer to the latest Publication Manual of the American Psychological Association. Basic and comprehensive guides to APA style and referencing are available here.

**To ensure a blind review**, identifying information such as author names should be removed from the manuscript. Self-citations should be in third person.

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## Appendix B

*Ethical Approval Letter*




Mental Health and Clinical Neurosciences Research Ethics Sub-Committee

11/01/2024

Supervisor: David Dawson

Applicant : Natasha Bloor

Project: 3154Online Yoga for Students Experiencing Distress: A Single Case Experimental Design into the Psychological Mechanisms of Change.

The committee is pleased to confirm that the above study now has approval on the basis of your application and any subsequent clarifications. You must conduct your research as described in your application, adhere to all conditions under which the ethical approval is granted, and use only materials and documentation specified in your application.

If you need to make any changes (for example to extend your data collection timeframe, change the mode of data collection, or the measures being used), you must create and submit an Amendment Form. To do this, select the 'Create Sub Form' option from the Actions Menu on the left-hand side of the page in the online system and then select 'Amendment Form'.

With best wishes

Dr Katy Jones and Dr Jen Yates

Chairs of the Mental Health and Clinical Neurosciences Research Ethics Sub-Committee

**Appendix C**

*Participant Information Sheet*




**Participant Information Sheet**

**Date: 05/1/2024 Version Number:2**

**Title of Study:** Online Yoga for Students Experiencing Distress: A Single Case Experimental Design into the Psychological Mechanisms of Change

**Name of Primary Researcher**: Natasha Bloor

**Local Researchers:** Dr Hannah Merdian, Dr Dave Dawson, and Dr Sharron Smith

**Ethics Reference Number:** 3154

We would like to invite you to take part in our research study. Before you decide we would like you to understand why the research is being done and what it would involve for you. If you have any questions about the study after reading this information sheet, please contact a member of the research team on the contact details provided below.

**What is the purpose of the study?**

The number of students reporting mental health difficulties is increasing and there is a need for more effective self-help interventions for students who are experiencing difficulties while at university. Yoga has been found to show

promising results in reducing levels of distress and improving wellbeing, but little is known about how yoga works to reduce distress and improve wellbeing.

The purpose of the research is to explore how yoga works and to assess the effectiveness of an online-yoga intervention for students. This will help to explore effective self-help interventions to help improve mental health and wellbeing in students and provide further understanding into how yoga can be used for this purpose.

**Why have I been invited?**

You are being invited to take part because you are a current university student who has indicated that you are experiencing feelings of depression, anxiety or/and stress and are not currently engaging in psychological treatment or regular yoga practice. We are inviting 10 participants like you to take part.

**Do I have to take part?**

It is up to you to decide whether to take part.  If you do decide to take part, you can click the option at the bottom of the page and you will be asked to electronically sign a consent form. If you decide to take part, you are still free to withdraw at any time and without giving a reason. This would not affect your legal rights.

**What will happen to me if I take part?**

In total, this study will take 16 weeks to complete. This includes 4 weeks before we start the intervention, 6 weeks of yoga practice, and a follow-up period of another 6 weeks. At the start of the study, you will be asked to fill out questionnaires relating to depression, anxiety, and stress, as well as wellbeing on a weekly basis for 4 weeks. You will then gain access to a 30-minute yoga class which will be sent via an online weblink to a web-based software for creating and distributing surveys called QuestionPro, the aim is to practice the intervention video every day for 6 weeks. You will also be sent weekly questionnaires to measure self-compassion which relates to how you think and look after yourself, and psychological flexibility which relates to your ability to remain in the present moment regardless of unpleasant experiences, while choosing to engage in behaviours which are in line with your personal values. A

weekly diary will also be used to record how you are doing with regards to the intervention and how often you practiced and any reasons you may not have practiced. We recognise that some days you may not be able to take part for various reasons which is very useful for us to know about. At the end of the study you will also be sent a brief survey to gather information around what changes you might have noticed through taking part in the yoga practice, and any feedback you would like to provide about the study. After the 6 weeks, the intervention ends. The final period of the study consists of a 6-week follow-up period; You will be sent weekly questionnaires relating to yoga practice, self-compassion, and psychological flexibility for 4 weeks, and questionnaires relating to depression, anxiety, and stress, as well as wellbeing for the last 2 weeks.

Overall, the study will take 16 weeks, and participation will take approximately 15 minutes per week during the baseline and follow-up period, whereas during the intervention period participation will take approximately 4 hours per week including 30 minutes of daily yoga practice. The study will all be delivered online using QuestionPro and all materials and intervention videos can be accessed there.

You will be asked to provide your email address so that reminders to complete study documentation can be sent to you. All participants are eligible to receive a free yoga mat for taking part in the study, if you would like to receive a yoga mat you will be asked to provide your home address- but this is optional.

**What are the possible disadvantages and risks of taking part?**

During the study there will be questionnaires to complete every week which will take around 15 minutes to complete, as well as the yoga intervention for 6 weeks. This is quite a substantial commitment of time. The intervention is designed for beginners of all fitness levels. However, it is important to consider any illnesses or health issues you may have and knowing your body’s limits within the practice.

**What are the possible benefits of taking part?**

Based on existing research into yoga, taking part in the yoga intervention may have health and wellbeing benefits and can be a good starting point for getting into a new healthy habit. Additionally, taking part in the study will help to further the research into interventions to help students manage depression, stress, and anxiety while at university.

Participants will be offered a free yoga mat to take part in the study that you can keep afterwards, and those who complete the study will be sent a £10 gift voucher to say thank you for the time you've spent completing the study.

**What happens when the research study stops?**

At the end of the study, the data will be analysed and used in the thesis research project, it may also be published in an academic journal or presented at conferences. I can share with you a copy of the findings if you consent to this. All your personal details will be deleted once the project information has been shared.

**What if there is a problem?**

If you have a concern about any aspect of this study, you can email the researchers using the contact details provided below. If you remain unhappy and wish to complain formally, you can do this by contacting The University of Nottingham: Hr@nottingham.ac.uk.

If something does go wrong, and you are harmed during the research, and this is due to someone's negligence then you may have grounds for a legal action for compensation against the University of Nottingham, but you may have to pay legal costs.

**Will my taking part in the study be kept confidential?**

We will follow ethical and legal practice and all information about you and data from the study will be handled in confidence. This information will be kept strictly confidential, stored on a secure and password protected device. Anonymisation will be used to ensure individual data sets will not be identifiable. Under UK Data Protection laws, the University is the Data Controller (legally responsible

for the data security), and the Chief Investigator of this study (Natasha Bloor) is the Data Custodian (manages access to the data).

This means they are responsible for looking after your information and using it properly. Your rights to access, change or move your information are limited as we need to manage your information in specific ways to comply with certain laws and for the research to be reliable and accurate. To safeguard your rights, we will use the minimum personally – identifiable information possible.

You can find out more about how we use your information and to read our privacy notice at:

https://www.nottingham.ac.uk/utilities/privacy.aspx

The data collected for the study will be looked at and stored by authorised persons from the University of Nottingham who are organising the research. They may also be looked at by authorised people from regulatory organisations to check that the study is being carried out correctly. All will have a duty of confidentiality to you as a research participant and we will do our best to meet this duty.

If you provided a home address this will be permanently deleted once the yoga mat has been posted and delivered. Email addresses will be kept by the University of Nottingham for 3 months after the end of the study so that we are able to contact you about the findings of the study (unless you advise us that you do not wish to be contacted). This information will be kept separately from the research data collected and only those who need to will have access to it. All other data (research data) will be sent to admin at University of Nottingham and will be kept securely for 7 years. After this time your data will be disposed of securely. During this time all precautions will be taken by all those involved to maintain your confidentiality, only members of the research team given permission by the data custodian will have access to your personal data.

In accordance with the University of Nottingham, the Government, and our funders' policies we may share our research data with researchers in other Universities and organisations, including those in other countries, for research

in health and social care. Sharing research data is important to allow peer scrutiny, re-use (and therefore avoiding duplication of research) and to understand the bigger picture in particular areas of research. Data sharing in this way is usually anonymised (so that you could not be identified) but if we need to share identifiable information, we will seek your consent for this and ensure it is secure. You will be made aware then if the data is to be shared with countries whose data protection laws differ to those of the UK and how we will protect your confidentiality.

**What will happen if I don't want to carry on with the study?**

Your participation is voluntary, and you are free to withdraw at any time, without giving any reason, and without your legal rights being affected. If you withdraw, we will no longer collect any information about you or from you, but we will keep the information about you that we have already obtained as we are not allowed to tamper with study records and this information may have already been used in some analyses and may still be used in the final study analysis. To safeguard your rights, we will use the minimum personally identifiable information possible.

**What will happen to the results of the research study?**

The research study will be submitted in partial fulfilment of the requirements for the Trent Doctorate in Clinical Psychology (DclinPsy). I also intend to submit the findings to a peer-reviewed journal to disseminate the findings. Participants will not be identified in any publications or disseminations of the study. Participants who consent to be contacted will be contacted post-study and offered an information sheet highlighting the key findings of the research.

**Who is organizing and funding the research?**

This research is being organised and funded by the University of Nottingham.

**Who has reviewed the study?**

All research in healthcare is looked at by independent group of people, called a Research Ethics Committee, to protect your interests. This study has been

reviewed and given favourable opinion by the Universities Research Ethics Committee.

Further information and contact details:

Primary Researcher: Natasha Bloor

Trainee Clinical Psychologist

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Co-investigators: Dr Hannah Lena Merdian

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Qualified Yoga Teacher

Senior Clinical Tutor

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**Appendix D**

*Debrief Letter*




**Participant Debrief Sheet**

**Date: 05/1/2024 Version Number: 2**

**Title of Study:** Online Yoga for Students Experiencing Distress: A Single Case Experimental Design into the Psychological Mechanisms of Change

**Name of Researchers:** Natasha Bloor, Dr Hannah Merdian, Dr Dave Dawson and Dr Sharron Smith

**Contact Details of Researchers:**

Lead researcher Natasha.Bloor@nottingham.ac.uk

Primary Research Supervisor Hmeridan@lincoln.ac.uk

Secondary Research Supervisor ddawson@lincoln.ac.uk

Field Research Supervisor shsmith@lincoln.ac.uk

**We'd like to thank you for showing an interest in the research and taking part in the screening stage of the study, however, we would like to inform you that you are not eligible to take part in the rest of the study.**

**Why am I not eligible to take part?**

This could be because you are already participating in regular yoga practice or regular psychological treatments. Alternatively, it could be because the answers

you provided in the screening questionnaire indicated that you are either below the threshold for moderate-severe depression, anxiety, or stress or above the threshold.

**What was the aim of the study?**

The aim of the study was to explore what changes occur in relation to yoga practice which leads to the reductions in distress and improvements in wellbeing, and to assess the effectiveness and utility of an online yoga intervention for students who are distressed.

**Questions**

If you have any further questions about the study, please feel free to email the lead researcher (NB) or their supervisor at any time on the email addresses above.

**Further help and support**

You may wish to seek support for your mental health and you can do this by contacting your GP to arrange an appointment. Alternatively, you may wish to seek support through your university's wellbeing services, if you are not a student at the university of Nottingham or Lincoln please contact the student wellbeing service at the university you attend.

University of Nottingham Counselling service
counselling.service@nottingham.ac.uk

University of Lincoln Support Service studentsupport@lincoln.ac.uk

You may also wish to seek support through the Samaritans who are available 24/7 and can be contacted for free on 116 123 or via email: jo@samaritans.org. Here is a link to the website for further information on how to contact a Samaritan Contact Us | Samaritans

If you have any ethical concerns regarding the current research, your treatment as a participant or your involvement in the study please feel free to contact research-ethics@nottingham.ac.uk

**Appendix E**

*Demographic Questions*

1) What is your age?

2) What gender describes you?
   -Male
   -Female
   -Non-binary
   -Prefer not to say
   -Self describe (text box)

3) What is your ethnicity?

-self-describe (text box)

4) What year of university are you currently in?

-Foundation year

-First year

-Second year

-Third year

-Other (text box)

5) Do you have any disabilities?

-Yes (free text box to provide further information about the impact of disability)

-No

## Appendix F

*Recruitment Poster*

University of Nottingham
UK | CHINA | MALAYSIA

**Have you been feeling low in mood, anxious, or stressed while at university? Are you interested in taking part in online yoga classes to improve your wellbeing?**



**We are currently looking to recruit university students who are currently experiencing elevated levels of distress and are not currently engaging in psychological treatment or regular yoga classes.**

What would I have to do?

- Read the consent form and agree to take part in the screening questionnaire and complete this.
- If you are eligible participation will include filling in weekly questionnaires and diaries for 16 weeks and practicing daily yoga for 6 weeks.
- At the end of the yoga intervention you will also be asked to reflect on any changes you have experienced through taking part

What is the purpose of the research?

- The purpose of the research is to explore the effectiveness of online yoga as a self-help intervention for students to help improve mental health and wellbeing.
- The study also aims to provide further understanding into how yoga works to reduce distress.

Why should I take part?

- If you choose to take part you will be provided with a free yoga mat that you can keep after the study, if you complete the study you will also be sent a £10 gift voucher.
- Taking part in the study will help to further the research into interventions to help students manage depression, stress, and anxiety while at university.

**Thank you for taking the time to read this poster. If you are interested in taking part, please click the link below to complete a short screening measure to see if you are eligible to participate.**

**https://unioflincoln.questionpro.eu/t/AB3u09VZB3vqcA**

# Appendix G

## *Weekly Diary*

**Weekly Diary**

| Item | Question | Options | |
|---|---|---|---|
| 1 | How many times did you practice the yoga video this week? | Six-Seven<br>Five- Six<br>Three-Four<br>One-Two<br>Zero<br>Other | |
| | *Please provide any additional information regarding how many times you practised.* | | |
| 2 | Did you encounter any personal challenges that got in the way of you practicing?<br><br>*If yes, please provide information about challenges.* | Yes<br>No | Injury<br>Workload<br>Illness<br>Time<br>Other |
| 3 | Were there any external barriers that effected your practice this week?<br><br>*If yes, please provide information about barriers?* | Yes<br>No | Noise<br>Distractions<br>Interruptions<br>Connection<br>Other |
| 4 | Did you practice any other yoga apart from the video?<br><br>*If yes, please provide information about the yoga practice you completed?* | Yes<br>No | Self-practice<br>Attended a class<br>Alternative online<br>Other |
| 5 | Is there anything else you wish to add regarding your practice this week? | | |

*Note.* Weekly diary items that participants will complete during the intervention phase

## Appendix H

*Client Change Interview Adapted from Elliott et al. (2001)*

| Item | Question |
|---|---|
| 1. | What has engaging in yoga been like for you? |
| 2. | What changes if any did you notice since engaging in yoga? |
| 3. | If you noticed changes, what do you think caused these changes? |
| 4. | What has been the most helpful thing about yoga? |
| 5. | What has been the most unhelpful thing about yoga? |
| 6. | Were there parts of the yoga that were difficult but still Ok or helpful? |
| 7. | Do you think there was anything missing from the yoga practice? |
| 8. | What has it been like for you to be involved in the study? |
| 9. | Do you have any suggestions around improving the intervention or the way the study was ran? |

**Extended Paper**

# 1. Extended Background

## 1.1 Historical and Cultural Context of Yoga

The practice and science of yoga is believed to have been developed thousands of years ago, predating the origin of religious belief systems (Basavaraddi et al., 2015). The term *"yoga" is derived from the Sanskrit root "yuj,"* meaning "to yoke" or "to unite." It is traditionally understood as the union of the individual self with the universal consciousness. This notion of union reflects yoga's core emphasis on integrating body, mind, and spirit to achieve balance, clarity, and liberation (Feuerstein, 2012). Historically, yoga is most closely associated with ancient Indian traditions and philosophies, particularly those found in Hinduism, Buddhism, and Jainism. Early references to yoga practices were found in *The Yoga Sutras of Patanjali*, written around 200 BCE (Bryant, 2015). These sutras conceptualised yoga as an eight-limbed practice, including ethical rules (*yama and niyama)*, physical postures (*asana*), breath control (*pranayama*), sensory withdrawal (*pratyahara*), concentration (*dharana*), meditation (*dhyana*), and ultimately spiritual absorption (*samadhi*) (Bryant, 2015).

While yoga originated in Eastern spiritual traditions, particularly within India, it has since become a global phenomenon (Singleton & Byrne, 2008). In Western culture, yoga began gaining popularity in the late 19th and early 20th centuries through the influence of Indian teachers, who introduced physical forms of yoga to Western audiences (Singleton, 2010). As yoga has been adopted in Western societies, its original spiritual and philosophical elements have frequently been replaced by an emphasis on physical exercise and general wellness. Research found that yoga practitioners in the UK reported greater initial and continued physical intentions of practising yoga rather than spiritual (Ivtzan & Jegatheeswaran, 2015). Western interpretations of yoga frequently emphasise the physical aspect of the practice, often to the exclusion of its philosophical and spiritual roots (Govindaraj et al., 2016; Shaw & Kaytaz, 2021). This contrasts with traditional Eastern conceptions, where the primary aim is spiritual insight and harmony between the mind and body (Basavaraddi,

2015). As a result, many Western yoga practices resemble exercise routines that promote flexibility, strength, and stress reduction, rather than spiritual discipline or ethical living (Shaw & Kaytaz, 2021). This shift has prompted criticism from scholars and practitioners who argue that the cultural and spiritual essence of yoga is becoming lost in modern Western contexts (Govindaraj et al., 2016; Webb et al., 2022).

Nonetheless, the popularity of yoga continues to grow, particularly as a mind-body practice. The National Centre for Complementary and Integrative Health (NCCIH) (2021) define mind-body practices as activities that aim to strengthen the connection between the mind (thoughts, emotions, awareness) and the body (physical sensations, movement, physiological processes) to promote overall health and wellbeing. This includes activities such as Tai Chi, acupuncture, meditation, and various relaxation techniques (NCCIH, 2021). Contemporary psychological research increasingly highlights the potential of yoga in supporting wellbeing by promoting interoceptive awareness, emotional regulation, and the integration of mental and physical states (Gard et al., 2014; Schmalzl et al., 2015; Telles et al., 2014). These mind-body benefits have contributed to the rise of yoga as a complementary mental health intervention, particularly among populations seeking non-pharmacological self-help tools (Park & Slattery, 2021).

In recent years, the accessibility of yoga has expanded significantly through digital platforms, with online yoga becoming increasingly popular (Brosnan et al., 2021). The COVID-19 pandemic further accelerated this shift, as in-person classes were replaced with virtual offerings (Brinsley et al., 2021). Online yoga allows individuals to access guided practices remotely, often at lower cost, and at times that suit their schedules. Research suggests that online yoga can be a feasible and acceptable method of intervention, with users reporting convenience, anonymity, and reduced barriers to participation (Brosnan et al., 2021).

### 1.2 General Effectiveness of Yoga

A growing body of research has examined the effectiveness of yoga as an intervention for mental health difficulties, with several systematic reviews and

empirical studies reporting beneficial outcomes. In a systematic review and meta-analysis of randomised controlled trials (RCTs), Brinsley et al. (2021) found that yoga produced greater reductions in depressive symptoms than waitlist control, treatment as usual, and an attentional control intervention. The authors reported a moderate overall effect, with a higher frequency of yoga practice associated with larger reductions in depressive symptoms. Notably, the RCTs included in this review spanned a diverse range of disorders, including post-traumatic stress disorder (PTSD), anxiety, schizophrenia, bipolar disorder, and alcohol dependence, highlighting the breadth of conditions for which yoga has been applied. However, the review also noted that few studies compared yoga with other established interventions, and that methodological weaknesses, poorly defined intervention protocols, and inconsistent reporting limit the strength and generalisability of the findings.

Complementing this evidence, Deepeshwar and Kumar (2022) investigated a short-term yoga-based lifestyle intervention among young adults who had reported anxiety and depression in the past six months. Over two weeks, participants who received yoga therapy demonstrated significant reductions in anxiety and depression alongside improvements in general health, compared to a control group receiving lifestyle counselling. These findings suggest that even brief but intensive yoga interventions may be beneficial in alleviating symptoms and enhancing wellbeing. Despite this, the study's non-randomised design, lack of follow-up, and short duration reduce confidence in the robustness of the findings.

Extending this evidence base, Uebelacker and Broughton (2018) reviewed published research on yoga for depression, anxiety, and PTSD. The most substantial evidence emerged for depression, with meta-analyses showing yoga to be significantly more effective than usual care, relaxation, or aerobic exercise in reducing symptoms. Yoga has also demonstrated benefits for depression and anxiety symptoms in medical populations such as cancer, fibromyalgia, and prenatal depression, with preliminary findings suggesting potential utility in treating generalised anxiety disorder and PTSD in veteran populations. However, the review highlighted that most studies were small and methodologically limited, with substantial variation in the type, intensity, and

components of yoga used, as well as the strength of control conditions. In addition, the authors cautioned that while yoga appears generally safe and acceptable, potential risks such as physical injury, exacerbation of psychiatric symptoms, or adverse psychological reactions should be considered.

Taken together, the research suggests that yoga has demonstrated positive effects across a broad range of mental health conditions, particularly depression, anxiety, and stress-related disorders. While some limitations remain, such as variation in study design, intervention protocols, and the nature of control groups, the overall evidence indicates that yoga is an effective, accessible, and low-cost intervention.

### 1.3 Review of Mechanisms of Change in Yoga Literature

A growing body of research has attempted to identify the psychological mechanisms through which yoga exerts its positive effects on mental health. Despite this interest, the current literature presents a fragmented and conceptually inconsistent landscape. Psychological constructs such as self-compassion, psychological flexibility, interoceptive awareness, and mindfulness are frequently cited as mechanisms of change (MOC). However, studies often lack the theoretical and methodological clarity necessary to determine how these processes function within yoga interventions. Few studies rigorously distinguish between the procedural elements of yoga (physical postures, breathwork, and meditation), the process mechanisms that may elicit change, and the outcomes that are produced (Matko et al., 2022; Park et al., 2021). This conceptual ambiguity continues to limit our understanding of whether and how yoga facilitates psychological wellbeing.

For example, Gard et al. (2012) reported that a residential Kripalu yoga program improved quality of life and reduced stress, with self-compassion and mindfulness acting as mediators. However, these constructs were explicitly taught as part of the program, making it difficult to attribute observed changes solely to the yoga practice. Similarly, Avery et al. (2018) found that psychological flexibility and set shifting improved in veterans following a trauma-sensitive yoga intervention; however, methodological limitations, such as the

absence of a control group and inconsistent session attendance, make it challenging to draw firm conclusions. Dick et al. (2014) reported that yoga may reduce expressive suppression and potentially enhance psychological flexibility in women with PTSD. However, small sample sizes and reliance on self-report measures weakened the strength of these findings. More recently, Fox et al. (2024) conducted a large-scale cross-sectional study comparing yoga practitioners with non-practitioners using the Multidimensional Psychological Flexibility Inventory (MPFI), which offers improved psychometric properties over the widely used Acceptance and Action Questionnaire-II (AAQ-II). It was reported that yoga practitioners demonstrated significantly higher psychological flexibility and wellbeing than non-practitioners, though the effect sizes were small. Additionally, their analysis of the eight limbs of yoga showed that psychological flexibility was most strongly associated with ethical guidance (*yama)* and postures (*asana*), with smaller associations for the remaining limbs. These findings highlight that both ethical and physical aspects of yoga may be particularly relevant to psychological flexibility (Bennetts, 2022). However, the study was limited by the lack of control over participants' yoga styles, demographic imbalances between groups, and the cross-sectional design, which prevents causal inference

Systematic reviews have highlighted these concerns. Riley and Park (2015) and Meister and Juckel (2018) both identified self-compassion and mindfulness as recurrent mechanisms in yoga-based interventions. However, it was noted that most studies used designs that do not permit causal inference, such as cross-sectional or pre-post comparison designs. Additionally, the wide variation in yoga styles, intervention durations, and populations studied prevents meaningful comparison across studies and contributes to the inconsistency of findings. Park et al. (2021) attempted to address these limitations by assessing multiple potential mechanisms, including interoceptive awareness, self-compassion, and spiritual wellbeing, over a 12-week Kripalu yoga program. While the study demonstrated that most mechanisms were associated with reductions in stress, the lack of a control group limited the ability to rule out alternative explanations such as natural recovery or expectancy effects. In addition, the exclusion of individuals with psychiatric

diagnoses restricts the applicability of findings to populations who are often most in need of stress-reduction interventions.

A notable attempt to improve methodological rigour was made by Matko et al. (2022), who conducted a single-case experimental design study (SCED) to explore the effects of different components of yoga (meditation, physical postures, and ethical education) on body awareness, emotion regulation, self-compassion, and distress tolerance. Although the study offers promising insights into the nuanced effects of specific practices, variability in individual responses, particularly for body awareness, and potential researcher bias highlight the need for replication. Importantly, this study demonstrated that even within well-controlled interventions, psychological mechanisms such as interoception and emotion regulation may not shift uniformly across participants, highlighting the importance of examining individual change over time. A common issue across the literature is the interchangeable use of potential mechanisms as outcome measures. Constructs like mindfulness and self-compassion are frequently positioned both as mechanisms of change and as outcomes of yoga, making it challenging to develop a coherent understanding of the MOC that underpins positive outcomes from the existing literature.

The findings of Fox et al. (2024) further illustrate both the promise and limitations of current yoga research. The findings suggest that the eight limbs of yoga are significantly related to psychological flexibility. Furthermore, greater practice of the limbs of ethical rules (*yama*) and postures (*asana*) was associated with greater increases in psychological flexibility. However, the reliance on cross-sectional comparison and non-equivalent groups underscores the ongoing need for experimental and process-focused designs. Additionally, focusing on group-level differences does not capture the heterogeneity of individual responses to yoga practice, which may vary substantially depending on previous experience, engagement with specific limbs, and personal context.

Taken together, the existing literature highlights a pressing need for more precise and methodologically rigorous research to understand how yoga leads to psychological change. The lack of clear theoretical frameworks, the

inconsistent use of key constructs as both mechanisms and outcomes, and the predominance of group-level pre-post designs all contribute to an inconclusive evidence base. These gaps make it difficult to determine whether the observed benefits of yoga are due to specific psychological processes, the general structure of the intervention, or nonspecific factors such as group support. To advance the field, research must not only differentiate between the procedures, mechanisms, and outcomes of yoga interventions but also adopt designs capable of capturing individual-level patterns of change. Single-case experimental designs (SCEDs) offer a promising approach, enabling the detailed tracking of psychological processes within individuals over time. By focusing on self-compassion and psychological flexibility as potential mechanisms within a brief, accessible online yoga program, the current study aims to contribute more robust, causal evidence on how yoga may support psychological wellbeing, particularly among student populations at elevated risk of stress-related difficulties.

### 1.4 Acceptance and Commitment Therapy

Acceptance and Commitment Therapy (ACT) is a psychological approach that focuses on helping people live more meaningful and fulfilling lives, even when they are experiencing complex thoughts, feelings, or situations. ACT is rooted in behavioural psychology and underpinned by Relational Frame Theory (RFT), which explains how people learn to relate concepts and experiences through language. According to RFT, individuals form associations that link thoughts, emotions, or experiences to perceived positive or negative outcomes. When these relational patterns become rigid or overly dominant, they can limit psychological flexibility and contribute to unhelpful behavioural patterns (McHugh et al., 2016). ACT is considered part of the ‘third wave’ of cognitive behavioural therapy (CBT). In ACT, rather than trying to change, challenge or reduce thoughts, emotions, and bodily sensations, the focus is on changing the person's relationship with them (Hayes et al., 2006).

One of the underlying principles of ACT is that human life will inevitably involve both enjoyment and pain, and everything that makes life meaningful also comes with difficulties and suffering (Harris, 2019). The things that make

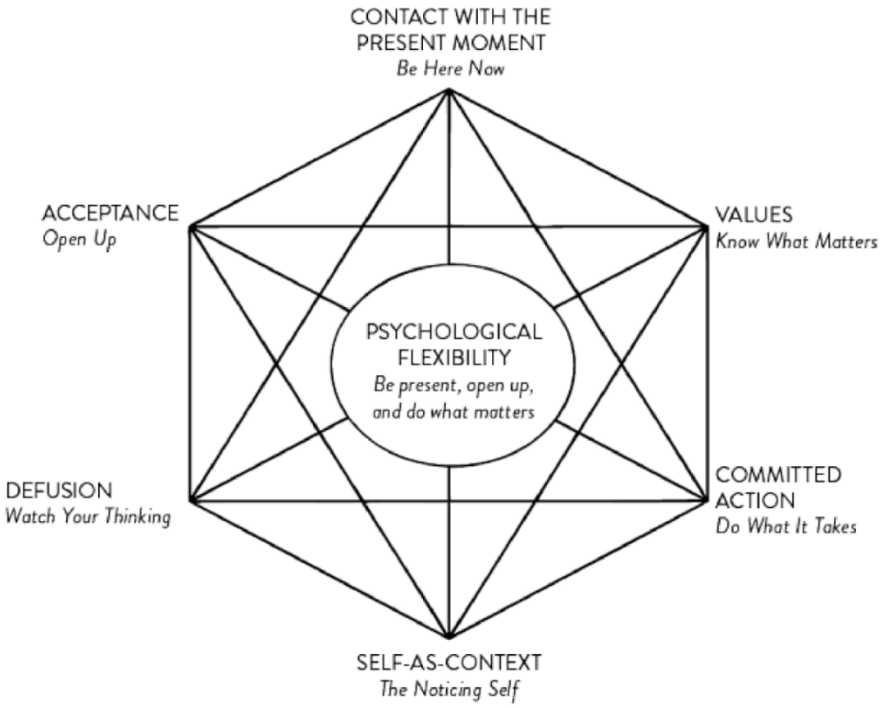
life meaningful in ACT are referred to as values. Values are described as a behavioural way of living that is freely chosen and focused on moving toward a way of living rather than achieving specific outcomes (LeJeune & Luoma, 2019). Unlike goals, which can be completed or checked off, values represent ongoing directions in life. As such, values can provide motivation and guidance for action, even when goals have not yet been achieved. Because values are never completed, there is always an opportunity for a person to move more closely into alignment with them (LeJeune & Luoma, 2019). ACT theory proposes that psychological suffering is often caused by attempts to avoid or control unwanted inner experiences, such as anxiety, sadness, or painful memories. This process, referred to as experiential avoidance, has been linked to a range of psychological difficulties (Hayes et al., 2012). In ACT, experiential avoidance refers to attempts to control or mitigate unpleasant internal experiences, which reduces an individual's ability to engage in values-based living, limiting opportunities for meaningful actions and leading to greater psychological distress (Hayes et al., 2012). Interventions in ACT, therefore, focus on targeting areas of the Hexaflex, comprising six interrelated core components to increase psychological flexibility and support engagement in valued living (see Figure 16) (Harris, 2019).

- Contact with the present moment: this relates to being psychologically present in the here and now, connecting and engaging with the experience, regardless of what the experience is.
- Values: this relates to being aware of what matters most, and with this awareness, considering if our behaviour aligns with our values.
- Committed action: this refers to taking effective action to move in the direction of values even when it is difficult.
- Defusion: this relates to learning to step back from thoughts and recognise them as mental events, rather than literal truths, so they can be noticed without automatically engaging with them.
- Acceptance: this relates to learning to allow uncomfortable internal experiences as part of life and making space for them without

trying to avoid or remove them. Importantly, acceptance in ACT is not the same as resignation; rather than giving up or withdrawing, acceptance enables individuals to engage fully in life while continuing to act in line with their values (Harris, 2019).

**Figure 16**

*ACT Hexaflex Model: Image from (Harris, 2019).*




### 1.5 Validity of the Acceptance and Action Questionnaire II (AAQ-II)

The Acceptance and Action Questionnaire-II (AAQ-II) is a shortened and revised psychometric measure of the original Acceptance and Action Questionnaire (AAQ-I) (Bond et al., 2011; Hayes et al., 2004). Due to criticisms around the internal consistency of the original AAQ and the complexity of the items, the AAQ-II was developed to provide a more understandable and psychometrically robust measure (Bond et al., 2011). The AAQ-II is designed to assess psychological inflexibility through evaluating the extent to which individuals engage in experiential avoidance of unwanted internal experiences

(Bond et al., 2011). It is the most widely used measure to assess the effectiveness of ACT interventions (Tyndall et al., 2019).

The reliability and validity of the AAQ-II were assessed across six samples with a total of 2,816 participants. The measure was reported to have good levels of internal consistency (.84), and good test-retest reliability at 3 months (.81) and 12 months (.79) (Bond et al., 2011). However, the construct and discriminant validity of the AAQ-II have been questioned. Wolgast (2014) argues that the items are more closely related to the measurement of psychological distress than psychological inflexibility. Many of the items are open to subjective interpretation, meaning that responses may reflect differences in emotional intensity or symptom presence rather than differences in how individuals relate to their internal experiences. As a result, high scores may not necessarily indicate psychological inflexibility, but rather a higher frequency or severity of negative thoughts and feelings. Building on the argument presented by Wolgast (2014), Tyndall et al. (2019) provided a critical examination of the concerns regarding the discriminant validity of the AAQ-II. They assessed the relationship between the AAQ-II and two measures: a measure of psychological distress (Depression Anxiety Stress Scale, DASS-21) (Lovibond & Lovibond, 1995), and a measure of experiential avoidance alone (Brief Experiential Avoidance Questionnaire, BEAQ) (Gámez et al., 2014). It was reported that the AAQ-II correlated more strongly with the measure of psychological distress than it did with the measure of experiential avoidance. This further suggests that the AAQ-II may primarily measure psychological distress rather than its proposed aim of measuring psychological inflexibility (Tyndall et al., 2019). This raises concerns about alignment with the core premise of ACT, which emphasises improving wellbeing despite the presence of psychological distress.

### 1.6 Compassion Focused Therapy

Compassion-Focused Therapy (CFT) is a psychological therapy designed to help individuals cultivate compassion toward themselves and others, particularly when experiencing shame, self-criticism, or distress (Gilbert, 2014). CFT is grounded in theories of evolutionary psychology, affective

neuroscience, and attachment, drawing on the idea that humans have evolved with regulation systems that shape how we emotionally relate to ourselves and others (Gilbert, 2014).

The concept of balancing three emotional systems (threat, drive, and soothing) is central to the CFT perspective. The threat system supports survival by identifying and responding to stimuli that may cause harm, triggering strong emotions like fear and anxiety. The drive system represents motivation to achieve and acquire resources by triggering emotions such as excitement and ambition. In contrast, the soothing system is linked to safeness, connection, and contentment, and triggers calming emotions (Kolts, 2016). CFT proposes that psychological difficulties, particularly shame and self-criticism, arise when the threat system is enlarged and the soothing system is underdeveloped (Gilbert, 2010). CFT, therefore, focuses on activating and strengthening the soothing system to achieve balance between the systems through compassion-based practices.

Compassion in CFT is defined as a sensitivity to suffering in oneself and others, accompanied by a commitment to alleviate it (Gilbert, 2010). Self-compassion involves responding to one's pain with kindness, mindfulness, and a sense of shared humanity (Neff, 2009). Gilbert's model extends this by incorporating physiological and evolutionary understandings of emotion regulation. CFT utilises interventions such as compassionate imagery, soothing rhythm breathing, and compassionate letter writing to foster a compassionate self-identity and mitigate threat-based responses (Kirby, 2017). CFT is particularly suited to individuals who experience high levels of shame or self-criticism and has been applied across a range of clinical populations, including those with depression, anxiety, eating disorders, and trauma histories (Leaviss & Uttley, 2015).

### 1.7 Relevance of ACT and CFT

The inclusion of ACT and CFT provides the theoretical foundation for the key psychological constructs examined in the present thesis. Specifically, ACT offers a clear conceptualisation of psychological flexibility, while CFT provides a framework for understanding self-compassion as a way of relating to distress.

These constructs are central to the aim of the thesis, which is to examine psychological flexibility and self-compassion as potential mechanisms of change within a yoga intervention for university students. By outlining these therapeutic models, this helps to clarify how the study's core variables are theoretically grounded and establishes a coherent link between the broader theoretical background and the purpose of the research.

### 1.8 Aims and Unique Rationale for the Study

In light of the limitations of the existing MOC literature, there is a pressing need for methodologically robust studies that explicitly test psychological mechanisms within yoga interventions using clear operational definitions and temporal sequencing. The current study seeks to address these gaps by closely examining self-compassion and psychological flexibility as mechanisms of change in a six-week, online yoga intervention delivered to university students. By employing SCED, the study enables detailed individual analysis of change and facilitates causal inference of effects. This approach enhances methodological validity by retaining experimental control through baseline comparisons. The findings aim to contribute to a more coherent understanding of how yoga works and to inform the development of accessible, mechanism-informed interventions for psychological wellbeing in student populations.

## 2 Extended Methods

### 2.1 Ethical Considerations

The process of obtaining ethical approval resulted in several amendments to the study informed by feedback from the ethics committee. One key modification was the implementation of a unique participant identification code, which ensured anonymity while allowing for the accurate linkage of each participant's responses across various measures. The inclusion criteria were also revised. Initially, the study aimed to recruit individuals with moderate to severe symptoms of depression, anxiety, or stress. However, in response to concerns from the committee regarding the potential delay in treatment for individuals experiencing significant psychological distress, the eligibility criteria were adjusted to include students with mild to moderate symptoms.

Furthermore, the original exclusion of participants currently receiving psychological treatment was reconsidered. The committee noted that such exclusion could inadvertently delay necessary care. Consequently, the revised protocol allowed individuals undergoing psychological treatment to participate, with this information recorded and considered during data analysis. Lastly, the committee raised concerns about the planned use of the vocal tones "Om" and "Ram" in the yoga intervention, as these are associated with the Hindu religion. To address this, the intervention was modified to incorporate the humming bee breath technique, a neutral vocal practice without religious connotations.

### 2.2 Epistemological Position

The present study was designed and conducted from a critical realist perspective. Critical realism combines a realist ontology, which assumes that there is a reality independent of human thought and perception, with a critical epistemology, which recognises that our understanding of this reality is shaped by social, cultural, and historical contexts (Creswell & Clark, 2017). This means that while an objective reality exists (for example, the effect of a yoga intervention on mental health), how individuals access and interpret that reality is influenced by their background, beliefs, and experiences (Maxwell & Mittapalli, 2010; Mukumbang, 2023). Critical realism also recognises that both researchers and participants bring their own biases to the research process, which may impact findings (Creswell & Clark, 2017).

This philosophical stance offers a middle ground between positivism, which views knowledge as objective and based only on observable facts, and constructivism, which sees knowledge as subjective and constructed by individuals. Critical realism acknowledges that knowledge is fallible and shaped by context yet also asserts that we can make informed inferences about reality through methodologically sound research (Maxwell & Mittapalli, 2010). This makes it an ideal position for mixed methods research, which combines both quantitative and qualitative methods. Critical realism aligns well with the SCED method used within the current study. SCED, especially with a multiple baseline approach, allows each participant to act as their own control. This helps identify potential changes resulting from the intervention, while also taking into account

that each person may experience those changes differently. This reflects the critical realist view that outcomes are shaped by both real mechanisms (such as the effects of yoga) and individual factors like personal history and environment (Mukumbang, 2023). Critical realism also emphasises that all forms of measurement are fallible and subject to interpretation (Mukumbang, 2023). This is acknowledged in the current study in two ways. Firstly, as a researcher with a background in yoga, I am aware that my personal experiences may influence my interpretation of the data. I took steps to address my personal bias by checking my interpretation of the data during research supervision meetings. Secondly, participants' feedback and self-reports are understood as subjective and shaped by their perspectives. These limitations are recognised and considered throughout the study.

The critical realist position also informed the decision to employ a mixed-methods design. This approach values both quantitative data, which can reveal patterns and changes over time, and qualitative data, which help explain why and how those changes occur (Maxwell & Mittapalli, 2010). In this study, quantitative measures are used to assess change in individuals' mental health and mental wellbeing, while qualitative feedback provides insight into participants' personal experiences of the intervention. This supports a deeper understanding of the outcomes and reflects the critical realist interest in exploring both causal relationships and individual meaning (Creswell & Clark, 2017).

In summary, critical realism offers a clear and consistent foundation for the current study. It supports the use of SCED to explore individual change, recognises the value of combining different types of data, and allows for a balanced interpretation of results that includes both objective outcomes and subjective personal context.

### 2.3 Study Design

A mixed-methods single case experimental design (SCED) approach was selected as the most appropriate and practical design for the current study. SCEDs are increasingly used in applied health research to evaluate the effects of psychological and behavioural interventions in real-world settings (Bentley et

al., 2019; Kazdin, 2019). This design was chosen to address concerns in the existing mechanisms of change (MOC) in yoga literature, which often lacks methodological rigour and the inability to establish causal links between the intervention and outcomes (Meister & Juckel, 2018; Riley & Park, 2015). A key strength of SCED is that participants act as their control, which reduces the influence of between-group variability and allows for a more precise assessment of change related to the intervention (Smith, 2012). Unlike group-based designs, SCEDs do not exclude outliers or rely on large sample sizes, making them especially useful in small-scale studies or in emerging areas of research (Aydin et al., 2024).

A non-concurrent multiple baseline design was utilised so that participants could begin the study at different times. This offered flexibility in recruitment and reduced delays in commencing participation, which was particularly important given the challenges of recruiting students experiencing psychological distress. An A-B-A withdrawal design was employed, enabling close monitoring of changes during the baseline, intervention, and washout phases. This helped to explore whether improvements were maintained or declined once the intervention was removed. The inclusion of a washout phase is important in SCED as it strengthens causal inference by examining whether observed changes are dependent on the presence of the intervention (Rassafiani & Sahaf, 2010).

Although SCEDs are sometimes criticised for limited generalisability, their clinical utility is often greater than that of large-scale randomised controlled trials (RCTs) when exploring individual patterns of change (Aydin et al., 2024). In the current study, the single-case approach enabled a detailed examination of how each participant responded to the introduction and withdrawal of the yoga intervention. The design also allowed examination of the proposed MOC by observing individual variation in responses across the phases of the study.

### *2.3.1 Service User Involvement*

As part of the study design process, I presented the proposed methodology and intervention at a research forum, where I received feedback from academic colleagues and the Service User and Carer Advisory Panel

(SUCAP). The SUCAP panel raised concerns about the initial proposal, which involved 45-minute yoga sessions over an eight-week period. They felt this length and duration could be burdensome for participants, particularly given the target population of students experiencing psychological distress while managing academic commitments. The panel highlighted that the proposed intervention might feel overwhelming and could impact participants' ability to engage consistently. The lead author (NB) and research team agreed that this was a valid and important consideration. Based on this feedback, the intervention was revised to include 30-minute sessions delivered over a six-week period. This suggestion was supported by existing literature indicating that shorter yoga interventions can still be effective in reducing symptoms of psychological distress in student populations (Uebelacker et al., 2018). The change was therefore made to ensure the intervention remained both evidence-informed and accessible for the intended student participants.

**2.3.2 Participant Inclusion and Exclusion Criteria.** To be eligible, individuals were required to be currently enrolled in a university course at any level of study, from foundation to final year. This was to ensure that students at any level of their studies could participate in the research to maximise recruitment opportunities.

As the study aimed to evaluate the effectiveness of yoga as a self-help intervention for student distress, all participants needed to exhibit at least mild to moderate psychological distress at baseline. This ensured that the intervention had the potential to demonstrate measurable change. Distress was operationalised using the Depression Anxiety Stress Scale-21 (DASS-21; Lovibond & Lovibond, 1995), with inclusion thresholds set at: Depression, 10-20; Anxiety, 8-14; and Stress, 15-25. These thresholds correspond to mild to moderate symptom severity, as outlined in the DASS-21 manual. Participants scoring within this range were considered appropriate for a low-intensity, self-directed intervention such as yoga. Participants also needed to be physically capable of engaging in light exercise, as the intervention involved regular yoga practice. This ensured that participants could participate safely in the physical elements of the intervention. Additionally, they were required to be able to read

in English and follow basic instructions, as the intervention materials and assessments were delivered in English without additional language support.

Participants were excluded if they reported engaging in regular yoga practice (defined as more than once a week) in the six months preceding the study. This was to avoid potential bias introduced by practice effects or skill level in yoga. Individuals presenting with severe or extremely severe levels of psychological distress on any DASS-21 subscale (Depression > 21, Anxiety >15, Stress >26) were excluded due to concerns that participating in a self-help intervention might delay more appropriate professional support. These individuals were instead signposted to appropriate mental health support and provided with a detailed debrief sheet containing referral resources and the research team's contact information (see Appendix B).

Despite monitoring of the data within the screening procedures, one participant (P6) was later identified as having scored within the severe range for anxiety at baseline. This oversight was addressed in a supervision meeting with the research team. As the participant had completed the intervention without any issues, demonstrated reductions in anxiety post-intervention, and had been provided with information on accessing support services, it was agreed that no further action was required.

In summary, the inclusion and exclusion criteria were carefully designed to safeguard participant wellbeing, ensure the sample was appropriate for a self-help intervention, and enhance the internal validity of the findings by reducing the impact of extraneous variables.

***2.3.3 Recruitment and Sample Size.*** A sample size of 10 participants was planned, which was loosely informed by existing research indicating that dropout rates in exercise-based interventions can vary widely (Vancampfort et al., 2021). However, as no pilot data were available to guide expectations for this specific intervention, a conservative approach was taken by recruiting a higher number of participants, with the anticipation that fewer than half would complete the study. In SCED guidelines, a minimum of three participants is required to demonstrate replication of effects (Smith, 2012). The decision to employ a mixed-methods design was grounded in a critical realist

epistemological position. The qualitative component complemented the SCED by offering contextual insight into each participant's experience of the intervention, thereby helping to explain how and why change may have occurred and what personal biases may have influenced change.

Once the study had received ethical approval, recruitment began on 5th March, 2024, through a study-specific social media account entitled "Online Yoga Research," which featured a yoga-related image and was used to share the recruitment poster. Emails were also sent to two UK university wellbeing services requesting advertisement of the study, but no replies were received despite multiple follow-ups. Uptake through social media was initially slow, with low engagement even after daily reposting of the study. To broaden recruitment, the lead researcher (NB) contacted a public social media page dedicated to student research projects, which agreed to share the study poster on 15th May, 2024. This led to an unexpected spike in interest: within a few days, 45 people had completed screening, of whom 30 were eligible to participate.

At this point, the lead author (NB) consulted with the research team to discuss the best course of action. Given the number of students who had already completed baseline measures, it was agreed that withholding the intervention would not be an appropriate course of action. The study therefore proceeded with a larger sample than initially planned, resulting in approximately three times the number of participants anticipated.

## 2.4 Demographics and Baseline Distress of Dropouts

**Table 6**

*Demographic Information and Baseline Distress Scores for Participants who Did Not Complete the Study*

| PP | Age | Gender | Ethnicity | Year of study | Overall DASS | Depression | Anxiety | Stress |
|---|---|---|---|---|---|---|---|---|
| DO1 | 22 | Female | White and Black African | 2nd | 28 | 11(Mild) | 6(N) | 11(N) |
| DO2 | 23 | Female | White and Black Caribbean | 3rd | 27 | 10(Mild) | 9(Mild) | 8(N) |
| DO3 | 21 | Female | Black British | 2nd | 28 | 8(N) | 9(Mild) | 11(N) |
| DO4 | 21 | Female | White and Black African | 2nd | 33 | 10(Mild) | 11(Mod) | 12(N) |
| DO5 | 23 | Female | White English | 3rd | 29 | 8(N) | 10(Mod) | 11(N) |
| DO6 | 31 | Female | Irish Traveller | 3rd | 39 | 16(Mod) | 14(Mod) | 9(N) |
| DO7 | 20 | Female | White and Black African | 1st | 23 | 11(Mild) | 6(N) | 6(N) |
| DO8 | 21 | Female | White and Black Caribbean | 3rd | 27 | 7(N) | 10(Mod) | 10(N) |
| DO9 | 24 | Female | White and Black African | 3rd | 26 | 10 (Mild) | 8(Mild) | 8(N) |
| DO10 | 24 | Male | White and Asian | 3rd | 30 | 7(N) | 14(Mod) | 9(N) |
| DO11 | 21 | Female | Mixed Race | 3rd | 30 | 9(N) | 10(Mod) | 11(N) |
| DO12 | 22 | Female | White and Black African | 2nd | 28 | 10(Mild) | 8(Mild) | 10(N) |
| DO13 | 21 | Male | White and Black African | 3rd | 28 | 10(Mild) | 8(Mild) | 10(N) |
| DO14 | 21 | Female | White and Black African | 2nd | 25 | 9(N) | 8(Mild) | 8(N) |
| DO15 | 22 | Male | White and Asian | 2nd | 20 | 6(N) | 8(Mild) | 6(N) |
| DO16 | 22 | Female | White and Black African | 2nd | 32 | 14(Mod) | 11(Mod) | 7(N) |

*Note.* Demographic information and baseline distress scores from the DASS-21 subscales for participants who dropped out of the study. Key: DASS= Depression, Anxiety, Stress Scale, DO= dropout, N= Normal, Mod=Moderate, Sev= Severe.

## 2.5 Measures

To align with the study's aims and its critical realist epistemological stance, a combination of quantitative and qualitative methods was used to assess both the process and outcomes of a six-week online yoga intervention. In single-case experimental design (SCED) research, shorter or revised measures are often employed, as repeated assessments necessitate tools that can sensitively capture change over time while minimising participant workload (Smith, 2012; Ganz & Ayres, 2018).

Demographic information was collected to contextualise and adequately describe the sample. This was important for assessing whether the sample reflects patterns observed in previous yoga research, such as the overrepresentation of women (Simard & Henry, 2009; Gard et al., 2012; Lemay, 2019). Additionally, demographic data provided insights into which student groups are interested in yoga, which can inform future intervention design and target audience considerations. The collection of demographic variables is considered a key methodological standard in SCED research (Ganz & Ayres, 2018). See Appendix E for the demographic questionnaire.

All measures were administered via QuestionPro (a secure online survey platform) and were piloted by the lead researcher (NB) and colleagues prior to participant recruitment. The lead researcher (NB) also reviewed all items and scoring procedures to ensure accuracy and clarity in interpretation.

### *2.5.1 Quantitative Measures*

The CompACT-10 (Golijani-Moghaddam et al., 2023) was selected to assess psychological flexibility. Although the Acceptance and Action Questionnaire-II (AAQ-II) has historically been widely used in yoga research (Dick et al., 2014; Avery et al., 2018), concerns have been raised about its conceptual clarity and overlap with measures of psychological distress (Wolgast, 2014; Tyndall et al., 2019). The CompACT (Francis et al., 2016) was developed to address these limitations, and the CompACT-10 provides a shorter version suitable for repeated assessment in SCEDs while retaining strong psychometric validity. Evidence shows the measure demonstrates high

internal consistency, good test–retest reliability, and strong convergent validity (see Table 2). In addition to reducing participant burden, the CompACT-10 offers a conceptually robust alternative to the AAQ-II, capturing openness to experience, behavioural awareness, and valued action.

Self-compassion was assessed using the Self-Compassion Scale–Short Form (SCS-SF; Raes, 2011). Self-compassion is particularly relevant to yoga practice as it reflects the tendency to respond to difficulties with kindness rather than self-criticism and has been shown to mediate the benefits of contemplative practices like yoga (Neff, 2004). The SCS-SF provides a reliable global index of self-compassion with good internal consistency and stability over time (see Table 2), while reducing participant workload. Importantly, the items capture how people typically respond to difficult life situations, making it directly relevant for evaluating yoga's psychological effects. The scale has also been widely applied in yoga research, further supporting its appropriateness in the current study (Mathad et al., 2017; Snaith et al., 2018).

Outcome measures assessed broader mental health and wellbeing. The Depression Anxiety Stress Scale-21 (DASS-21; Lovibond & Lovibond, 1995) was included to measure psychological distress. It is a widely used instrument with well-established internal consistency, test–retest reliability, and sensitivity to change (Henry & Crawford, 2005; Ronk et al., 2013). The DASS-21 is effective for classifying reliable and clinically significant change in individuals, making it particularly useful in SCED designs where individual-level outcomes are prioritised. The Short Warwick-Edinburgh Mental Wellbeing Scale (SWEMWBS; Stuart-Brown et al., 2009) was used to capture positive aspects of wellbeing. This measure complements symptom-focused outcomes by assessing mental wellbeing and positive psychological changes. It is brief, psychometrically robust (with strong reliability and convergent validity), and considered acceptable in various clinical populations (Shah et al., 2021).

Taken together, these measures provided a balanced and psychometrically sound assessment of both process mechanisms (psychological flexibility and self-compassion) and outcomes (psychological distress and wellbeing). Their demonstrated reliability and validity (see Table 2),

alongside their brevity, ensured that clinically meaningful change could be evaluated while minimising participant burden and aligning with the study's critical realist stance.

**2.5.2 Qualitative Measures.** Weekly diaries were included as a complementary data source to capture participant engagement with the yoga intervention, explore barriers and challenges to practising yoga, and provide participants with a space to share any additional reflections about their experiences each week. This method was chosen because it enabled regular check-ins with participants across the intervention phase, offering the potential to contextualise changes observed in the quantitative measures and enhance understanding of individual practice patterns. All participants completed the weekly diaries, although responses were generally brief and limited in detail. Aside from highlighting occasional barriers or challenges to practice (such as a lack of time and illness), participants provided little narrative information and did not elaborate on their experiences of yoga practice. As such, while the diaries served as a valuable tool for monitoring adherence and capturing minimal contextual data, they contributed less to the depth of qualitative findings than initially anticipated.

The Client Change Interview (CCI) was used at the end of the intervention to elicit participants' perceived changes in relation to the yoga programme, their understanding of the source of these changes, and any challenges or difficulties associated with engagement. The version used in this study was adapted from Elliott et al.'s (2001) original nine-item CCI (see Appendix F; Journal paper). All participants completed the CCI, and unlike the diaries, the CCIs generated richer qualitative data by encouraging participants to reflect retrospectively on the overall impact of the intervention. These insights proved particularly valuable for interpreting the quantitative results and how participants had experienced the intervention.

***2.5.3 Missed Process Measures.*** An error occurred during the survey setup, resulting in missing process measure data for weeks 3 and 6 of the intervention phase. This occurred due to a scheduling error in the study emails and the attached links, where the links to the CompACT-10 and SCS-SF were

omitted, and only the qualitative and outcome measures were administered at the intervention midpoint and post-intervention. Consequently, instead of the intended six data points for process measures across the intervention phase, only four were collected. This gap reduced the ability to thoroughly examine hypothesised changes in psychological flexibility and self-compassion over time. As a result, the strength of causal inferences that can be drawn about the intervention's mechanisms of change was weakened (Kratochwill et al., 2010).

This omission had important implications for the planned analyses. In SCEDs, visual analysis requires sufficient repeated measures to allow meaningful inspection of level, trend, variability, and immediacy of effect across phases (Lane & Gast, 2014). The reduction in data availability at the midpoint and end of intervention limited the ability to track temporal patterns of change in psychological flexibility and self-compassion, thereby reducing confidence in detecting functional relationships between the yoga intervention and these proposed mechanisms of change. Similarly, the fewer data points weakened the application of the Percentage of Data Points Exceeding the Median (PEM) effect size calculation and Fisher's Dual Criterion methods, which rely on an adequate series length to provide stable effect estimates (Fisher et al., 2003; Ma, 2006). The omission of this data weakened the causal inferences that can be drawn regarding the mechanisms of change (MOC), reducing the strength of evidence for the hypothesised MOC (Kratochwill et al., 2010). Future research should pilot-test scheduling systems to minimise the risk of such errors and ensure complete data sets across all phases.

At these critical time points, the gaps in the data can have a negative impact, as they can interrupt the continuity of tracking changes in self-compassion and psychological flexibility over time. This resulted in issues in critically evaluating the changes in the mechanisms that preceded improvements in results or have emerged concurrently. All these aspects weaken the causal inferences regarding the effects of online yoga on the participants.

### 2.6 Development of the Intervention

The intervention consisted of one pre-recorded 30-minute yoga session delivered in the style of Hatha yoga. Participants were asked to practice the same yoga-intervention video daily for six weeks. Adherence was monitored by sending a different link to the intervention each week and incorporating a text box where participants were required to enter their unique participant number in order to access the video.

While searching the literature, the lead author (NB) came across a study that examined the feasibility and acceptability of an online yoga intervention for mood disorders. Within this study, the researchers reported that the yoga intervention was experienced positively and led to improvements in mood and provided a detailed description of the intervention utilised (see Table 6) (Uebelacker et al., 2018). The lead author (NB) contacted the authors of the paper via email to request access to the specific yoga video they used in their study; unfortunately, this was not available. This was discussed with my research supervisors, and we decided to create an intervention video that closely matches the description provided in Uebelacker et al. (2018).

The yoga teacher involved in the study was recommended by the field supervisor, who is also a qualified yoga teacher, the teacher was recommended based on her level of experience and interest in yoga research. The yoga teacher was a qualified yoga instructor with 20 years of experience and over 1500 hours of teacher training. The lead author (NB) and field supervisor (SS) met with the yoga teacher online on two occasions to discuss the study aims and development of the intervention. We discussed the outline of the yoga session published in Uebelacker et al. (2018) and made some adaptations to suit the current study (see Table 3). We included a safety message to remind participants to practice within their limits, as the practice is unsupervised and takes place at home. We also removed the use of the vocal tones “Om” and “Ram” due to religious connotations, as highlighted by the ethics committee; these were replaced with more neutral vocal tones such as the humming bee breath.

**Table 7**

*Breakdown of 30-minute Yoga Intervention Video*

| Yoga Component | Time Taken | Description |
|---|---|---|
| Breathing practices (Pranayama) | 5 minutes | While in a seated position, participants are guided through a breathing practice including the ocean-sounding breath and alternate nostril breathing. Vocal tones of “om” and “ram” are used to guide attention to breathing. |
| Warm-ups (Asanas) | 10 minutes | Warm-up postures include cat-cow, puppy pose, standing forward fold, standing cat-cow, standing swings, prayer pose, and breath of joy. |
| Standing and Floor postures (Asanas) | 10 minutes | Postures including warrior one and warrior two (on each side), participants gently flow in and out of each pose before holding, and the movement is attuned to the breath pattern and followed by floor postures of cobra, child’s pose, wind-relieving pose, and knee down twist. |
| Meditation (Dhyana) | 5 minutes | Participants are guided into the final resting pose, where they lie flat on their backs and return to breathing practice and a final chant of “om”. |

*Note.* Yoga intervention breakdown presented in Uebelacker et al (2018).

## 2.7 Analysis

The study data were collected online through QuestionPro and transferred by the lead author (NB) to an Excel spreadsheet. The transferred data were then entered and double-checked by the lead author (NB). This was then used to create graphs and populate tables for further analysis.

### *2.7.1 Baseline Stability*

The aim was to achieve stability or deterioration in the process measures of psychological flexibility and self-compassion; this is a recommended requirement in SCED research to demonstrate an effect (Smith, 2012). Additionally, SCED research is based on baseline logic, meaning that participants serve as their control for evaluating change, hence the requirement of stability in order to evaluate change (Lane & Gast, 2014). Stability of the baseline data was determined using stability envelope calculations as described in Lane and Gast (2014). The baseline data were analysed using the within-condition analysis of graphed data steps (see Figure 17). Measures of central tendency, such as the mean, median, and range, are used to calculate the stability envelope within the baseline (Lane & Gast, 2014). Once a stability envelope had been calculated for each participant, stability was determined by calculating the number of baseline data points on or within the stability envelope. 80% of the data points within the baseline phase need to be within +25% of the median to be classed as stable. See Table 8 for information on participants' baseline stability. Although it is advised to extend the baseline phase if variability is observed, this was not completed in this study due to ethical considerations of withholding the intervention from students who were experiencing psychological distress.

**Figure 17**

*Baseline Stability and Visual Analysis Methods as presented in Lane and Gast (2014)*

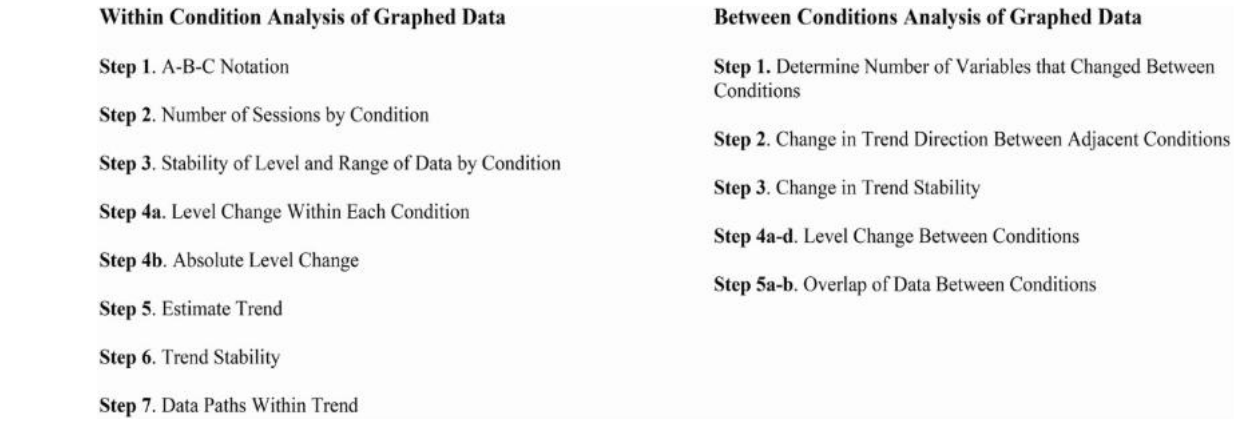


**Table 8**

*Participant Baseline Stability*

| PP | CompACT-10 | SCS-SF |
|---|---|---|
| P1 | X | X |
| P2 | X | X |
| P3 | X | √ |
| P4 | √ | √ |
| P5 | √ | √ |
| P6 | √ | X |
| P7 | √ | √ |
| P8 | X | √ |
| P9 | X | X |
| P10 | √ | √ |
| P11 | √ | √ |
| P12 | √ | √ |
| P13 | X | X |
| P14 | X | √ |

*Note.* Baseline stability was determined using the stability window as described in Lane and Gast (2014). PP: Participant; CompACT-10: measure of Psychological Flexibility; SCS-SF: Self-Compassion Scale-Short Form; √= stable baseline, X= unstable baseline

**2.7.2 Visual Analysis.** The data from the process measures (CompACT-10 and SCS-SF) were used to create two-line graphs for each participant. Line graphs are the most commonly used format to present ongoing data collected in SCED research (Lane & Gast, 2014). A step-by-step guide of between-condition visual analysis in SCED research presented in Lane and Gast (2014) was utilised to analyse the data and track changes over the phases of the study (see Figure 17). Visual analysis is considered the hallmark for interpreting effects in intervention studies using SCED (Kratochwill et al., 2013). Data analysis was used to compare the data in the baseline and intervention phases. The graphs were analysed for changes in trend (progress over time), level (magnitude of the change), and variability (stability of the change over time) upon the introduction and withdrawal of the intervention (Kazdin, 2019).

***2.7.3 Effect size and Fisher's Dual Criteria.*** The Percentage of data Exceeding the Median (PEM) method was used to calculate treatment effect sizes. The PEM approach (Ma, 2006) was selected as it provides a straightforward and widely used method for quantifying effect sizes in SCED research. This involves identifying the median score from the baseline phase and then calculating the proportion of intervention and washout data points that exceed this value. A greater proportion of data points above the baseline median is interpreted as evidence of a positive treatment effect. In contrast, scores that remain close to or below the baseline median indicate a limited or adverse effect. PEM is considered advantageous compared to earlier overlap indices because it incorporates all baseline data rather than relying on a single point, thereby reducing the influence of outliers and ceiling/floor effects (Lenz, 2013). However, PEM has also been criticised for potentially inflating effect size estimates and failing to account for changes in trend across phases, which may increase the risk of Type I errors (Wolery et al., 2010).

To strengthen the validity of visual analysis and compensate for the weakness of the PEM method, the Fisher et al. (2003) conservative dual criterion (DC) was applied. This method systematically evaluates changes in data patterns by requiring a specified number of data points to exceed both a projected trend line and the baseline median. However, this method recommends five data points within the intervention phase; however, due to an

error in the study procedure, only four data points were collected (Fisher et al., 2003). Despite this, the four data points in the intervention phase still meet the standards for SCED research, which states an intervention phase should contain at least three data points (Kratochwill et al., 2012). In the current study, a systematic change was observed using the DC method, as indicated by the fact that seven of the eight data points in the intervention and washout phases were above both the trend and median lines (Fisher et al., 2003; Swoboda et al., 2010). The lead author (NB) applied the DC method to all participant graphs, and the research team independently reviewed the analysis to ensure accuracy and consistency. While Tau-U is a widely used statistical method in SCED research, it was not selected for this study. Instead, the DC approach was more suitable as it aligns more closely with the recommended analytic standards for SCED research, which emphasise visual analysis as the primary method for determining intervention effects (Kratochwill et al., 2013). In contrast, the DC method is more conservative, reducing the likelihood of Type I errors, and remains visually transparent and accessible. Its focus on clear, observable, and practical change made it more suitable for the aims of this study.

***2.7.4 Reliable Change Index and Clinically Significant Change.*** Data from the outcome measures of psychological distress and mental wellbeing (DASS-21 and SWEMBS) were used to create bar chart graphs, and changes between the baseline, midpoint, post-intervention, and follow-up phases were analysed. Bar charts were selected because they provide a simple format for comparing outcome data upon the completion of the study (Lane & Gast, 2014).

The quantitative self-report data for the process and outcome measures were subjected to reliable change index calculations (RCI). If a reliable change was determined, a clinically significant change (CSC) was also assessed. The RCI value was used to assess reliable change across the phases of the study (see Table 4) and between the baseline and post-intervention scores (Table 5). An RCI calculator developed in Microsoft Excel was utilised to determine the minimum amount of score change required on each psychometric measure for that change to be considered statistically significant at the 95% confidence level. The RCI was calculated using each measure's standard deviation (SD)

and internal consistency (Cronbach's alpha, α) (see Table 9). By inputting the SD and α values into the calculator, RCI thresholds were calculated for each measure. The thresholds represent the minimum change in score required for that change to be considered statistically reliable:

- CompACT-10 (Golijani-Moghaddam et al., 2023): RCI = 10
- Self-Compassion Scale – Short Form (SCS-SF) (Neff et al., 2021): RCI = 8
- Depression Anxiety and Stress Sub Scales – 21 (DASS-21) (Henry & Crawford, 2011): RCI = 6
- Short Warwick–Edinburgh Mental Wellbeing Scale (SWEMWBS) (Ng Fat et al., 2017): RCI = 4

These thresholds were then used to determine whether each participant showed a reliable increase, decrease, or no meaningful change on each measure during different phases of the study. This helped to understand how each person changed over time. If reliable change was demonstrated, CSC was then determined based on published normative data and criteria from existing literature. CSC was calculated for the DASS-21 subscales, overall SWEMBS, and overall SCS-SF scores. There is no established normative data available for the CompACT-10; therefore, CSC could not be determined within this measure. CSC can be calculated using three criteria.

**Criterion A:** An individual's post-intervention score falls outside of the clinical range by more than two standard deviations from the mean score of a clinical population, in the direction of improvement.

**Criterion B:** An individual's post-intervention score falls within the non-clinical range, exceeding a cutoff defined as two standard deviations below the mean of the non-clinical population.

**Criterion C:** An individual's post-intervention score is closer to the mean score of the non-clinical population than to the mean of the clinical population.

As the normative data available for the DASS-21 includes both data from a clinical and non-clinical population, criterion C was applied to this data. The clinical sample data came from outpatients attending a private therapy clinic

(Ronk et al., 2013). The SWEMBS and the SCS-SF are wellbeing scales, and clinical population norms do not exist; therefore, criterion B was applied to this data to establish CSC. Normative data from the general population in England were used for the SWEMBS (Ng Fat et al., 2017). The norms presented in this study were split between age groups and males and females. The two age groups covered by the participants in the current study, along with the means for men and women in each group, were combined and then divided to calculate the mean and standard deviation relevant to the current study.

Normative data from a student sample were available for the SCS-SF, which were used to establish the CSC (Neff et al., 2021) (see Table 9). However, the data used an alternative scoring method as described by Neff et al. (2021), where the means of the six subscales in the SCS-SF are used to calculate a total mean. Whereas, initially in the current study, the twelve items were totalled as described by Raes et al. (2011). To determine CSC, the scoring of the SCS-SF was reviewed by the lead author (NB), and the subscales and total means were calculated and displayed in brackets next to the totalled SCS-SF scores (see Table 4).

**Table 9**

*Normative Data used for RCI and CSC Calculations*

| Clinically Significant Change (CSC) | | | | | Reliable Change Index (RCI) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Non-Clinical norms | | | Clinical norms | | | | |
| Measure | Paper | Sample (N) | Mean | SD | Sample | Mean | SD | Alpha | SD |
| CompACT-10 | Golijani-Moghaddam et al. (2023) | 399 | 36.97 | 8.97 | - | - | - | .83 | 8.97 |
| SCS-SF | Neff et al. (2021) | 411 | 2.98 | 0.99 | - | - | - | .94 | 0.99 |
| DASS-21 Depression | | | 6.34 | 6.97 | | 13.32 | 11.10 | .96 | 11.10 |
| | | 2,914 | | | 1,000 | | | | |
| DASS-21 Anxiety | Ronk et al. (2013) | | 4.70 | 4.91 | | 9.09 | 8.82 | .92 | 8.82 |
| DASS-21 Stress | | | 10.11 | 7.91 | | 15.01 | 10.00 | .95 | 10.00 |
| SWEMBS | Ng Fat et al. (2017) | 27,169 | 23.49 | 3.71 | - | - | - | .84 | 3.71 |

*Note.* CompACT-10: measure of Psychological Flexibility; SCS-SF: Self-Compassion Scale-Short Form; DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Mental Wellbeing Scale. N: Number; SD: Standard Deviation; Alpha: Alpha Coefficient.

***2.7.5 Qualitative Analysis.*** Framework analysis was chosen as the most appropriate qualitative method due to its compatibility with the aims and structure of the current study. An inductive approach was adopted, allowing themes to emerge naturally from the data and focusing on the participants' perspectives (Gale et al., 2013). Unlike thematic analysis, which is often used for rich, in-depth narrative data, framework analysis is well-suited to short,

focused responses, such as those generated from weekly diaries and CCI in this study (Smith, 2012). The qualitative data were not extensive or highly complex, often consisting of just a few concise statements from each participant. This made the matrix-based structure of framework analysis especially useful, as it allowed for systematic comparison across individuals without overwhelming detail and depth (Gale et al., 2013). Framework analysis provides a transparent and systematic process that enables researchers to examine patterns within and across participants, while preserving the integrity of each individual's experience (Ritchie & Spencer, 1994). This was particularly important for this study as it involved comparing multiple cases over time and seeking insight into both shared and individual experiences of the intervention. The method's transparency and emphasis on organising data into meaningful patterns made it an ideal fit for triangulating with quantitative findings. While thematic analysis offers greater flexibility, it may be less effective in studies where brevity, structure, and consistency across multiple cases are required. Ultimately, framework analysis provided a practical and rigorous approach that aligned with the study’s scale, purpose, and applied focus.

**Table 10**

*Seven Stages of Framework Analysis*

| Stage | Description |
|---|---|
| 1. Transcription | As the participant data was already in text form in the weekly diary and client change interview, the first author became familiarised with this by reading twice, and the data was then copied into a Word document. |
| 2. Familiarisation | The first author reread all participant data, and initial thoughts, impressions, and ideas were recorded in a reflective diary. |
| 3. Coding | Line-by-line inductive coding was completed on all of the participants data. Inductive coding themes were developed by drawing themes from the data. |
| 4. Developing a working analytical framework | The first author inductively coded half of the weekly diary and client change interview data, and a research meeting was held.<br><br>During the meeting, the inductive themes and subthemes were discussed, collapsed, and developed into an analytical framework, agreed upon by all four authors. |
| 5. Applying the analytical framework | The framework was then applied to the rest of the data; codes were assigned numbers and colour-coded for effective organisation of the data and to highlight frequently occurring codes. |
| 6. Charting | The data were organised under each theme into an Excel spreadsheet; the first author completed the charting. |
| 7. Interpreting the data | When interpreting the data, the reflective diary and initial impression notes were reflected upon. The charting revealed clusters of data around specific themes; however, the importance of the data was not determined solely by frequency, and the meaning and importance of quotes were also considered. Once the themes were developed, the data around each timepoint for each theme was carefully analysed, and commonalities and differences were drawn out. |

*Note.* The stages of framework analysis as described in Gale et al. (2013)

# 3 Extended Results

## 3.1 Participants

Almost half (42.86%) of the study completers were in their second year of study, five (35.71%) were in their third year, two (14.29%) were in their first year, and one (7.14%) was in their foundation year. However, half of the participants who dropped out of the study were in their third year of university (8), seven (43.75%) were in their second year, and one (7.14%) was in their first year (See Tables 1 and 7).

Third-year students had the highest dropout rate within this study; this may be due to the academic workload and stress associated with final-year projects and demands (Fritz et al., 2021; George, 2024). There was a low representation of first- and foundation-year students, whereas second-year students appeared to be well represented and more likely to complete the study.

There were no significant differences between the completers and dropouts within the individual subscales of the DASS-21: Depression, $t(28) = 2.02$, $p = .053$, $d = 0.74$, Anxiety, $t(28) = 2.03$, $p = .051$, $d = 0.74.74$, Stress $t(28)=1.77$, $p=.088$, $d=.64$). Despite this, some differences were observed, and those who completed the study showed higher levels of baseline depression and anxiety. At baseline, all participants who later dropped out reported normal levels of stress. Their anxiety scores, however, varied: two participants (12.5%) were in the average range, six (43.75%) reported mild symptoms, and six (43.75%) reported moderate symptoms. In terms of depression, seven participants (43.75%) presented with normal levels, seven (43.75%) with mild symptoms, and two (12.5%) with moderate symptoms (see Table 6). Among those who completed the study, baseline stress levels were also essentially normal, except for P5. Anxiety scores were higher in this group: none presented with normal levels, four participants (28.57%) reported mild symptoms, nine (64.29%) moderate symptoms, and one (7.14%) severe symptoms. In the depression scores, four participants (28.57%) reported normal levels, seven (50%) reported mild symptoms, and two (14.29%) reported moderate symptoms (see Table 1).

Of the sixteen participants who dropped out of the study, ten participants (71.42%) dropped out after completing the full yoga intervention, three (18.75%) dropped out during the final week of yoga, and two participants (12.5%) dropped out during the intervention phase. One participant (6.25%) dropped out before practising any yoga.

### *3.2 Summary of Results for Each Participant*

**3.2.1 Participant One.** Participant one's baseline data for psychological flexibility (CompACT-10) showed improvement in a therapeutic direction, while self-compassion (SCS-SF) displayed a variable but decreasing trend.

Visual analysis of psychological flexibility data indicated a downward shift in level following the introduction of the intervention. The data demonstrated a slight improvement trend after the midpoint, with no apparent shift in level upon the withdrawal of the intervention. The data points in the washout phase were variable. However, based on the projected trend line, participant one deteriorated more than would be expected if no intervention had occurred. The effect size estimation (0.0) suggests a strong adverse effect of the intervention. Applying the RCI calculation revealed that no reliable changes in psychological flexibility occurred across the phases of the study. However, the DC analysis suggests that systematic reductions in psychological flexibility can be determined, as all data points in the intervention and washout phase are below both the median and trend lines. Overall, the findings suggest that the intervention had a negative impact on psychological flexibility for participant one.

For self-compassion, no apparent change in level was observed after the intervention began, and this trend continued throughout the intervention phase, with data points indicating a limited effect. There was no clear shift in level upon the withdrawal of the intervention, and the washout phase data showed no clear trend. Although participant one improved more than would be expected if no intervention took place, the effect size estimate (0.5) suggests no apparent effect. Additionally, the DC method was unable to detect a systematic change, and RCI calculations revealed that no reliable change in self-compassion could be determined across the phases of the study.

Participant one showed a decrease in psychological distress (DASS-21) at the midpoint; however, this decrease was not sustained throughout the intervention phase, and by the post-intervention point, they exhibited increased distress, which appeared to be maintained during the follow-up phase. RCI calculations demonstrated a reliable and clinically significant improvement in distress from baseline to the midpoint; however, this improvement was not sustained beyond this point. Despite these fluctuations in distress, mental wellbeing (SWEMBS) improved across the study, as supported by RCI findings showing a reliable and clinically significant change in mental wellbeing from baseline to midpoint, which was sustained at the final follow-up.

Class attendance data revealed the participant practised yoga an average of 4.16 times per week, exceeding the group mean of 3.7. In the qualitative data, they reported no significant barriers to participation. The participant described the experience positively, “it has been great”, focusing on physical benefits “, I gained endurance”, “I exercise every day”, and found “holding poses” difficult but manageable. They suggested the intervention should be “lesser”, though it was unclear whether this referred to session length or total duration.

**3.2.2 Participant Two**. Participant two demonstrated instability within the baseline data for psychological flexibility (CompACT-10) and self-compassion (SCS-SF), with both showing improvement. Psychological flexibility initially showed an improving trend, followed by a decrease at the final baseline data point. Self-compassion showed a variable but improving trend.

Visual analysis of psychological flexibility revealed a downward level shift after the intervention was introduced, which continued until the midpoint, after which an improving trend was observed. There were no clear changes in level after the intervention had been withdrawn, and the data points during this phase show variation. Based on the projected baseline trend line, participant two deteriorated more than would be expected in the absence of intervention, and the effect size estimates (0.0) suggest a strong negative effect of the intervention. RCI calculations showed no reliable changes in psychological flexibility occurred across the phases of the study. The DC analysis suggests

that systematic reductions in psychological flexibility can be determined, as all data points in the intervention and washout phase are below both the median and trend lines. Overall, the findings suggest that the intervention had a negative impact on psychological flexibility for participant two.

For self-compassion, no clear shift in level was observed following the introduction of the intervention, and a downward trend followed this. Data remained variable with a downward trend during the intervention phase, followed by a slight upward trend after the intervention was withdrawn. Based on the projected baseline trend, participant two deteriorated more than expected without intervention, and the effect size estimates (0.0) suggest a strong adverse effect of the intervention. The DC analysis showed no data points above both the trend and the median line, suggesting systematic reductions in self-compassion can be determined. RCI calculations showed no reliable changes in the intervention phase but indicated a reliable reduction in self-compassion from baseline to washout one. Overall, the intervention appeared to have an adverse effect on self-compassion for participant two.

Participant two showed slight increases in psychological distress (DASS-21) at the intervention midpoint, followed by decreased distress at post-intervention. However, for participant two, their distress levels increased again at the first and final follow-up. RCI calculations indicated no changes during the intervention, but a reliable and clinically significant increase in overall psychological distress at the final follow-up. Despite increases in overall distress, participant two showed reliable and clinically significant improvements in mental wellbeing (SWEMBS) from baseline to follow-up. Interestingly, they experienced improvements in wellbeing alongside increases in distress.

Class attendance data indicated that participant two practised yoga 3.33 times per week, which is below the group mean of 3.7. In the qualitative data, participants reported no barriers to participation and highlighted “stress relief” as the most helpful aspect, and “physical discomfort” as the least helpful. They reported gains in “flexibility” and “awareness of body mechanics”. While the qualitative data suggest subjective benefits, these were not reflected in the quantitative outcomes.

**3.2.3 Participant Three.** Participant three demonstrated instability within the baseline data for psychological flexibility (CompACT-10), with a decreasing trend, but stable baseline data for self-compassion (SCS-SF).

Visual analysis indicated no apparent change in level upon introduction of the intervention, followed by an increasing trend. However, changes were variable, and the final intervention point showed a downward shift, suggesting inconsistency. There were no clear changes in trend or level following the withdrawal of the intervention. Based on the projected baseline trend, participant three improved more than expected without intervention, and the effect size estimate (0.75) suggests a moderate effectiveness of the intervention. This is supported through the DC analysis, which suggests systematic change. However, RCI calculations did not indicate a reliable change. Despite this, the intervention appeared to have a positive impact on psychological flexibility for participant three.

Following the introduction of the intervention, there was a slight upward shift in level, which was followed by a downward trend with variability, indicating no clear effect on self-compassion. There was no shift in level upon the withdrawal of the intervention, and variable data points followed this with no clear trend. This was supported by RCI calculations and DC analysis, which showed no systematic or reliable changes in self-compassion. Although the baseline trend projected a gradual decline, most data points were above the line, suggesting outcomes were somewhat better than expected. However, the effect size estimate (0.0) suggests a strong negative effect from the intervention. Overall, the intervention did not lead to reliable or consistent improvements in self-compassion for participant three and may have been associated with a temporary decline.

Participant three showed an increase in psychological distress (DASS-21) at the midpoint, and a reduction at post-intervention follows this. Psychological distress is then seen to increase again at the first and final follow-up. RCI calculations showed a reliable and clinically significant improvement at the post-intervention phase, with scores returning to baseline at follow-up.

Mental wellbeing (SWEMBS) was observed to increase slightly, but RCI showed no reliable change in mental wellbeing.

Class attendance data showed that participant three practised yoga on average four times per week, above the group mean of 3.7. They reported no barriers to participation. They described the study as a “good experience,” noted “weight loss,” and attributed it to “yoga.” As with participant one, they found the “duration of yoga” difficult but manageable, although it was unclear whether this referred to session length or the total number of weeks. While qualitative feedback indicated physical benefits and a positive experience, these were only partially supported by the quantitative data.

**3.2.4 Participant Four.** Participant four showed stable baseline data for psychological flexibility (CompACT-10) and self-compassion (SCS-SF). Visual analysis of psychological flexibility revealed no immediate changes following the introduction of the intervention. Following this, a clear, gradual upward trend was observed during the intervention phase. In the washout phase, a downward shift occurred when the intervention was removed, though other data points were variable and lacked a consistent trend. Based on the projected baseline trend line, participant four’s psychological flexibility improved more than expected without intervention; however, effect size estimates (0.5) indicate no apparent effect. RCI calculations and the DC analysis showed that no systematic or reliable changes in psychological flexibility could be determined. Overall, although improvements were observed visually, the absence of reliable and systematic change suggests that the intervention’s impact on psychological flexibility was limited for participant four.

For self-compassion, visual analysis showed no apparent shift in level when the intervention began, followed by a consistent downward trend throughout the intervention phase. During the washout phase, there was an upward shift in level, accompanied by continued variability. Based on the projected baseline trend line, participant four deteriorated more than expected without intervention, and the effect size estimate (0.25) suggests a potentially negative effect of the intervention. RCI analysis indicated reliable deterioration in self-compassion from baseline to post-intervention. The DC method yielded

mixed results in the intervention phase, with two data points exceeding and two falling below the trend and median lines; however, systematic change could not be determined. These findings suggest the intervention appeared to have negatively impacted self-compassion for participant four, though the inconsistency and variability reduce confidence in this outcome.

Participant four showed a slight decrease in psychological distress (DASS-21) from baseline to midpoint, and again at the post-intervention point. An increase in psychological distress is observed during the follow-up phase. However, RCI calculations showed no reliable changes in psychological distress. These findings suggest that any initial reduction in distress was not maintained or statistically meaningful. Mental wellbeing (SWEMBS) showed minimal but variable changes across the study phases, with improvements at the midpoint and deterioration at the first follow-up. RCI calculations show no reliable changes were observed in mental wellbeing for participant four.

Participant four practised yoga an average of three times per week, slightly below the group mean of 3.7. They reported no personal or external barriers. Like participant one, they emphasised physical gains, including “enhanced strength,” “stronger muscles,” and found “improved flexibility” the most helpful part of yoga. “Learning to breathe properly” was noted as difficult but manageable. Overall, while qualitative feedback indicated physical benefits and no engagement barriers, these subjective experiences did not align with the quantitative findings, which showed inconsistent and unreliable psychological outcomes.

**3.2.5 Participant Five.** Participant five showed stable baseline data for psychological flexibility and self-compassion. Visual analysis of psychological flexibility revealed an immediate downward shift in level following the intervention's introduction. However, following this, the data points showed no clear trend. In the washout phase, an immediate upward shift in level occurred when the intervention was removed. However, this was not maintained, and the remaining data points were variable, lacking a consistent trend. Based on the projected baseline trend line, participant five deteriorated more than would be expected in the absence of intervention, and effect size estimates (0.0) suggest

a strong negative effect. However, RCI calculations showed no reliable changes in psychological flexibility occurred across the phases of the study**.** The DC analysis suggests that systematic reductions in psychological flexibility can be determined. Overall, the findings suggest that the intervention had a negative impact on psychological flexibility for participant five.

For self-compassion, visual analysis showed a decrease in level after the intervention began, followed by a slight upward trend. In the washout phase, no changes in level or trend were observed, and variability was low. Based on the baseline trend line, participant five deteriorated more than would be expected in the absence of an intervention, and effect size estimates (0.0) suggest a strong adverse effect of the intervention. RCI calculations indicated no reliable changes in self-compassion occurred across the phases of the study. In contrast, DC analysis suggests that systematic reductions in self-compassion can be determined. Overall, the findings suggest that the intervention had an adverse effect on self-compassion for participant five.

Participant five showed an increase in psychological distress (DASS-21) at the midpoint; however, this decreased by post-intervention and showed slight further decreases during follow-up. RCI calculations showed no reliable changes in psychological distress. However, a steady increase in mental wellbeing (SWEMBS) is observed, and RCI analysis shows reliable and clinically significant improvements in mental wellbeing at the midpoint and final follow-up.

Class attendance data revealed that participant five practised yoga an average of 3.5 times per week, slightly below the group mean of 3.7. In the qualitative data, they reported no significant barriers to participation. This participant emphasised “improved posture” and “balance and coordination”. They felt the most helpful thing about yoga was experiencing “pain relief”. While participant five reported subjective benefits from yoga, such as improved posture, balance, coordination, and pain relief, these positive experiences were not consistently reflected in the quantitative measures, which showed adverse outcomes.

**3.2.6 Participant Six.** Participant six showed stable baseline data for psychological flexibility (CompACT-10), and unstable baseline data for self-compassion (SCS-SF), with the self-compassion data showing an improving trend across the first three data points, followed by a downward change in level for the final baseline data point. Visual analysis of psychological flexibility revealed a slight upward shift in level following the introduction of the intervention, followed by variable changes throughout the intervention phase. Effect size estimates (0.0) suggest a strong adverse effect of the intervention. However, the more conservative methods, the DC and RCI analysis, suggest that systematic or reliable change cannot be determined. In the washout phase, a downward change in level occurred when the intervention was removed, although a clear increasing trend was observed across the other data points. Overall, the intervention appeared to have a possibly negative but inconclusive impact on psychological flexibility.

For self-compassion, visual analysis revealed no observable changes in level or trend after the intervention began, with limited change and low variability observed during the intervention phase. RCI supported this, and DC analysis indicated no reliable or systematic changes in self-compassion. However, based on the upward projected baseline trend line, participant six deteriorated more than would be expected in the absence of intervention and effect size estimates (0.5) show no apparent effect of the intervention. Once the intervention is withdrawn, there is a slight downward shift in level, which remains relatively stable across the washout phase. Overall, the intervention did not lead to reliable or consistent improvements in self-compassion for participant six.

Participant six showed no clear changes in psychological distress (DASS-21) at the midpoint and post-intervention point. A slight decrease is observed at first follow-up, but this is seen to increase again by the final follow-up. RCI calculations showed no reliable changes in overall distress across the phases of the study but did reveal reliable deterioration of stress from baseline to final follow-up. Mental wellbeing (SWEMBS) appears to be relatively consistent across the study, with some slight fluctuations, and RCI analysis shows no reliable changes in mental wellbeing.

Class attendance data revealed that participant six practised yoga an average of 3 times per week, which is below the group mean of 3.7. In the qualitative data, they reported no significant barriers to participation. This participant focused on both emotional and physical benefits of engaging in yoga, such as “enhanced balance” and, in contrast to the quantitative findings, they noted “it reduced stress”. They felt the most helpful thing about yoga was “improved sleep”. However, participant six noted that being involved in the study has meant “dealing with physical challenges”, suggesting they may have experienced some difficulties with engaging in yoga practice. This may reflect the increases in stress participant six experienced.

**3.2.7 Participant Seven.** Participant seven showed stable baseline data for psychological flexibility (CompACT-10) and self-compassion (SCS-SF). Visual analysis of psychological flexibility showed limited changes in response to the introduction of the intervention, followed by a slight decreasing trend with low variability across the intervention phase. Upon withdrawal of the intervention, there is a slight upward shift in level followed by variable data points with no clear trend. The data points did not deviate significantly from the trend line. However, most data points in the intervention phase fell below, and the effect size estimate (0.25) suggests a possible negative effect of the intervention. RCI and DC analysis indicated that a reliable or systematic change in psychological flexibility could not be determined. Overall, the lack of observed changes in the visual analysis and the absence of reliable and systematic change suggest that the intervention’s impact on psychological flexibility was limited for participant seven.

For self-compassion, visual analysis revealed no observable changes in level or trend after the intervention began. This was followed by a downward shift in level and variable data points, with no clear trend. During the washout phase, there was no change in level upon removal of the intervention, and data points showed variability. Based on the trend line, participant seven deteriorated more than would be expected in the absence of an intervention, and effect size estimates (0.25) suggest a potentially negative effect of the intervention. However, DC and RCI analysis indicate that no reliable or systematic changes in self-compassion can be determined. Overall, the visual observations of

deterioration, along with the absence of systematic or reliable change, suggest that the intervention may have had a negative but inconclusive impact on self-compassion for participant seven.

Participant seven showed significant decreases in psychological distress (DASS-21) at the midpoint; however, these changes were short-lived, and by the post-intervention point, distress had increased to levels greater than baseline. Slight reductions are seen during the follow-up phase. These changes are supported by RCI calculations, which showed reliable improvements in overall psychological distress and all subscales at the midpoint; however, these changes were not sustained. There is an observed increase in mental wellbeing (SWEMBS) at the midpoint; however, this was followed by decreases across the other phases of the study. RCI analysis revealed a reliable and clinically significant decline in mental wellbeing at the final follow-up. Participant seven is the only participant who experienced a worsening of their mental wellbeing, whereas most participants (64.3%) experienced improvements.

Class attendance data revealed that participant seven practised yoga an average of 4.33 times per week, which is above the group mean of 3.7. In the qualitative data, they reported no significant barriers to participation and a positive experience. They shared their views on being involved in the study, “amazing, it has been impactful” and shared that they felt “yoga provided a safe space for emotional release and reflection”. They highlighted emotional benefits, including “decreased stress and anxiety,” as well as health benefits such as improved sleep and physical health. However, they did note that they found adjusting to the yoga practice difficult and the time commitment unhelpful. Despite these positive perspectives, the quantitative data did not reliably or consistently reflect these changes.

**3.2.8 Participant Eight.** Participant eight showed stable baseline data for psychological flexibility (CompACT-10) and self-compassion (SCS-SF). Visual analysis of psychological flexibility showed a slight upward shift in level following the introduction of the intervention, with consistent data points but no clear trend. In the washout phase, a slight downward shift in level was followed by variable data points. All points were above the projected baseline trend line,

suggesting participant eight improved more than would be expected without intervention, and effect size estimates (1.0) indicate a strong positive treatment effect. However, DC analysis did not meet threshold to determine systematic changes in psychological flexibility, despite all data points in the intervention phase being above both the median and the trend line. Additionally, RCI calculations showed no reliable changes in psychological flexibility. Overall, it appears that participant eight may have experienced increased psychological flexibility in response to the intervention, but this could not be determined.

For self-compassion, visual analysis showed no observable changes in level or trend after the intervention began, followed by a downward shift and then a gradual upward trend. In the washout phase, there was no change in level upon the withdrawal of the intervention, and data remained consistent. Based on the projected trend line, participant eight deteriorated more than would be expected in the absence of an intervention; however, effect size estimates (0.5) indicate no apparent effects. RCI and DC analysis indicated no reliable or systematic changes in self-compassion.

Participant eight showed a significant decrease in psychological distress (DASS-21) at the midpoint. However, this was not maintained, and distress was seen to increase above baseline scores by post-intervention and remain at this level during the follow-up phase. The RCI analysis indicates reliable and clinically significant improvements in psychological distress and the depression and anxiety subscales at the midpoint. However, this was followed by a reliable and clinically significant worsening of psychological distress and the stress subscale during the follow-up phase. There was an observed improvement in mental wellbeing (SWEMBS) at the intervention midpoint, which showed fluctuation across the phases of the study but with an upward trend. RCI analysis demonstrated reliable and clinically significant improvements in mental wellbeing during the intervention phase, and these were maintained after the intervention was withdrawn.

Class attendance data revealed that participant eight practised yoga an average of 5.33 times per week, above the group mean of 3.7. In the qualitative data, they reported no significant barriers to participation. They described a

positive experience of the intervention: “The meditative aspects of yoga have helped me reduce stress and anxiety, leading to a calmer mental state.” They emphasised “enhanced mindfulness” and the benefits of “focusing on breathing and the present moment.” However, they also noted difficulty with aspects such as “finding inner stillness” and “inversions,” but still described the study as “educational.” Overall, while participant eight reported positive experiences and showed reliable improvements in wellbeing, these contrasted with increased distress and inconsistent changes in psychological flexibility and self-compassion, reflecting a mixed and contradictory pattern of outcomes.

**3.2.9 Participant Nine.** Participant nine showed unstable baseline data for both psychological flexibility (CompACT-10) and self-compassion (SCS-SF). Psychological flexibility showed a downward trend at baseline, while self-compassion data showed an upward trend.

Visual analysis of psychological flexibility showed no clear changes in level following the introduction of the intervention, with consistent data points and no trend across the intervention phase. In the washout phase, a slight upward shift in level was followed by variable data with no clear trend. Based on the baseline trend line, participant nine improved more than would be expected in the absence of an intervention; however, effect size estimates (0.0) indicate a strong adverse effect of the intervention, as none of the data points are above the median line. Despite this, RCI and DC analysis showed no reliable or systematic changes in psychological flexibility. Despite the contradictory findings, the intervention appeared to have minimal impact on psychological flexibility for participant nine.

For self-compassion, visual analysis showed no observable changes in level or trend during the intervention, with consistent data points indicating minimal response. In the washout phase, there was an upward shift in level upon the removal of the intervention, followed by a decreasing trend. Based on the projected trend line, participant nine deteriorated more than would be expected if no intervention took place, and effect size estimates (0.0) indicate a strong negative response. However, RCI and DC analysis indicated no reliable or systematic changes in self-compassion. Overall, the intervention did not

produce consistent or reliable improvements in self-compassion for participant nine.

Participant nine showed significant increases in psychological distress (DASS-21) at the midpoint, which reduced at post-intervention but remained higher than baseline distress. This was followed by observed increases at first follow-up and a reduction back to baseline levels by the final follow-up. RCI calculations supported this, showing reliable and clinically significant increases in overall distress during the intervention phase and first follow-up. Reliable and clinically significant increases were also observed in the stress subscale at both the midpoint and first follow-up points. Mental wellbeing (SWEMBS) showed slight decreases at midpoint, followed by steady improvements up until the first follow-up, and another slight decline was seen at the final follow-up. However, RCI analysis showed no reliable changes in mental wellbeing for participant nine.

Class attendance data showed participant nine practised yoga an average of four times per week, above the group mean of 3.7. In qualitative data, they reported no significant barriers to participation. However, in the CCI, they noted “chronic pain” and identified “injury risk” as the most unhelpful aspect of yoga. This may explain the increased psychological distress during the intervention. Although participant nine described yoga as helpful for pain, “It has helped me alleviate chronic pain, reduce tension and enhance overall physical health”, this same pain may have led to increased distress. They also reported physical improvements in flexibility and strength, as well as emotional benefits such as “stress relief.” Although they reported some benefits, chronic pain and concerns around injury may have contributed to heightened distress, suggesting the intervention was not psychologically beneficial for this participant.

**3.2.10 Participant Ten.** Participant ten showed stable baseline data for psychological flexibility (CompACT-10) and self-compassion (SCS-SF). Visual analysis of psychological flexibility revealed an upward shift in level following the intervention's introduction. A downward trend followed this, but the final data point again showed an upward shift in level. The variable data points showed no consistent trend. In the washout phase, there is a downward shift in level,

followed by variable data points, again showing no clear trend. All points were above or on the projected baseline trend line, suggesting that participant ten improved more than would be expected in the absence of an intervention; however, effect size estimates (0.5) indicate no apparent effect. The RCI and DC analyses also show no systematic or reliable changes in psychological flexibility across the phases of the study. Overall, while visual analysis suggested an initial improvement, the absence of a systematic change and a reliable effect indicates that the intervention's impact was inconsistent for participant ten.

For self-compassion, visual analysis showed no observable changes in level or trend after the intervention began, followed by a slight downward shift with limited variability. There was no apparent change in level upon the withdrawal of the intervention; following this, the data show a gradual downward trend with limited variation. Participant ten's baseline data showed consistency across the four data points, so the trend and median line are at the same level. Half of the data points are above the trend line, and half are below it, and the effect size estimate (0.5) indicates no apparent change in either direction. RCI and DC analysis indicated that reliable or systematic change could not be determined for self-compassion.

Participant ten showed a slight increase in psychological distress (DASS-21) at the intervention midpoint, which returned to the baseline level at post-intervention and remained relatively stable during the follow-up phase. RCI calculations showed no reliable changes in overall distress or any of the subscales across the phases of the study. There was an observed improvement in mental wellbeing (SWEMBS) from baseline to midpoint, which remained stable at the post-intervention point. Increases in mental wellbeing followed this during the follow-up phase. RCI calculations supported the observations, and participant ten experienced reliable and clinically significant improvements in mental wellbeing during the intervention and follow-up phase.

Class attendance data revealed that participant ten practised yoga an average of 3.5 times per week, slightly below the group mean of 3.7. In the qualitative data, they reported no significant barriers to participation. They

described a mixed experience of the intervention, noting that they found yoga “fun and stressful”. They felt that they had noticed changes in “comfort,” which they attributed to their “commitment” to the practice, overall reflecting a mixed response supported by both quantitative and qualitative data.

**3.2.11 Participant Eleven.** Participant eleven showed stable baseline data for psychological flexibility (CompACT-10) and self-compassion (SCS-SF). Visual analysis of the psychological flexibility data revealed an upward shift in level following the introduction of the intervention, accompanied by reduced variability during this phase. There is a downward shift in level upon the withdrawal of the intervention; however, this was followed by variable data points, showing no clear trend. All data points in the intervention phase exceed the baseline trend line, suggesting that participant eleven improved more than would be expected in the absence of an intervention. Effect size estimates (1.0) indicate a strong positive treatment effect. RCI calculations also show reliable changes in psychological flexibility from baseline to post-intervention. However, DC analysis did not meet the threshold; therefore, systematic change cannot be determined in psychological flexibility. Overall, the intervention appeared to have a positive impact on psychological flexibility for participant eleve**n,** which appeared to reduce once the intervention had been withdrawn.

For self-compassion, visual analysis revealed no observable changes in level or trend after the intervention began, with minimal changes and limited variability during the intervention phase. During the washout phase, there were no changes in level, and the data points were variable, indicating inconsistent outcomes. Based on the baseline trend, participant eleven improved more than would be expected in the absence of an intervention, and effect size estimates (1.0) indicate a strong positive effect. However, these changes were minimal and just above the median line, highlighting the sensitivity of the PEM method. RCI and DC analysis revealed no reliable or systematic changes in self-compassion across the study's phases.

Participant eleven showed an increase in psychological distress (DASS-21) at the midpoint of the intervention, followed by a decrease at the post-intervention point. This was followed by an increase at the first follow-up and a

decrease at the final follow-up, showing a variable and inconsistent pattern across the study phases. RCI calculations revealed no reliable changes in overall distress or any of the subscales across the phases of the study. There was an observed improvement in mental wellbeing (SWEMBS) from baseline to midpoint; however, decreases were seen at post-intervention, followed by increases in the follow-up phase. RCI calculations demonstrated reliable and clinically significant improvements in mental wellbeing at both the intervention midpoint and the final follow-up.

Class attendance data revealed that participant ten practised yoga an average of 3.83 times per week, slightly above the group mean of 3.7. In the qualitative data, they reported personal challenges to practising, such as experiencing illness, and external barriers, including distractions and noise. They described a positive experience of the intervention, noting that they found yoga “fun”. They felt they had noticed improvements in “physical health” which they felt were caused by “consistency” of the practice, they also noted emotional benefits “, reduced stress and anxiety”. However, they felt the “risk of injury” was unhelpful, and they found “back bends” difficult but still ok. However, these subjective positive experiences were not supported in the quantitative data, which suggests the yoga intervention had a limited impact. Despite the limited impact on other psychological functions, there were reliable improvements in mental wellbeing.

**3.2.12 Participant Twelve.** Participant twelve showed stable baseline data for psychological flexibility (CompACT-10) and self-compassion (SCS-SF). Visual analysis of psychological flexibility showed a slight upward shift in level following the introduction of the intervention. However, this is followed by a slight downward trend with limited variability. There was a downward shift in level upon the withdrawal of the intervention, followed by minimal changes in the trend or level. Based on the baseline trend, participant twelve improved more than would be expected in the absence of an intervention, and effect size estimates (1.0) indicate a strong positive effect. However, the DC analysis and RCI calculations show no systematic or reliable improvements in psychological flexibility. Although the PEM effect size estimate suggests improvements, observations and RCI calculations suggest that the intervention did not result in

a reliable or consistent improvement in psychological flexibility for participant twelve.

For self-compassion, visual analysis revealed an upward shift in level following the introduction of the intervention, followed by a downward shift and variable data points with no clear trend. There was no change in level after the removal of the intervention; subsequently, the data showed a slight downward trend in the washout phase. Half of the data points are above the trend line, and half are below, suggesting no clear change; however, effect size estimates (0.0) indicate a substantial adverse effect of the intervention. RCI and DC analysis indicated that a reliable or systematic change could not be determined for self-compassion.

Participant twelve showed an increase in psychological distress (DASS-21) at the intervention midpoint, which reduced at post-intervention but remained higher than baseline scores. Again, slight increases in distress are seen during the follow-up phase. This was supported by RCI calculations, which showed reliable and clinically significant deteriorations in overall psychological distress and the depression subscale at the intervention midpoint. There were reliable deteriorations in overall psychological distress from baseline across all phases of the study. In contrast, there was an observed improvement in mental wellbeing (SWEMBS) from baseline to post-intervention, which was followed by a slight reduction in the follow-up phase. RCI analysis also demonstrated reliable and clinically significant improvements in mental wellbeing at the midpoint and final follow-up. Overall, participant twelve showed a reliable increase in psychological distress alongside consistent and clinically significant improvements in mental wellbeing.

Class attendance data revealed that participant twelve practised yoga an average of 3.5 times per week, slightly below the group mean of 3.7. In the qualitative data, they reported time as a personal challenge they encountered. They described the intervention as “fun” and highlighted the physical benefits of “improved physical health” and the emotional benefits of “reduced stress and anxiety.” However, they also noted that they found “back bends” difficult but still okay and felt that the “risk of injury” was the most unhelpful aspect of yoga.

Overall, while participant twelve reported positive experiences and showed reliable improvements in wellbeing, these contrasted with increased distress and limited changes in psychological flexibility and self-compassion, again reflecting a mixed pattern of outcomes.

**3.2.13 Participant Thirteen.** Participant thirteen showed unstable baseline data for psychological flexibility (CompACT-10) and self-compassion (SCS-SF), with both showing improving trends.

Visual analysis of psychological flexibility revealed a downward shift in level following the introduction of the intervention; the data points exhibit variable changes during the intervention phase, with no clear trend. There was no shift in level upon withdrawal of the intervention, and a slight upward trend was observed across the washout phase. All points were below the projected baseline trend line, indicating that participant thirteen's deterioration exceeded expectations without intervention. Furthermore, effect size estimates (0.0) suggest a strong adverse effect. However, DC and RCI analysis showed an absence of reliable or systematic change in psychological flexibility, in either direction. Overall, the intervention appeared to have a limited impact on psychological flexibility for participant thirteen.

For self-compassion, visual analysis revealed a downward trend in level following the introduction of the intervention, followed by an upward shift, with variable data points indicating no clear trend. During the washout phase, there was a slight downward shift in level after the intervention was removed; subsequently, the data showed a slight upward trend. Based on the baseline trend, participant thirteen deteriorated more than would be expected in the absence of an intervention, and effect size estimates (0.25) suggest a possible adverse effect. However, RCI and DC analysis indicated that systematic or reliable change could not be determined in self-compassion.

Participant thirteen showed an increase in psychological distress (DASS-21) at the intervention midpoint, which was maintained at post-intervention. Distress was observed to increase again at the first follow-up and then significantly decline by the final follow-up. This was supported by RCI calculations, which showed reliable and clinically significant increases in overall

psychological distress from baseline across all phases of the study. There were also reliable increases in the stress subscale at the final follow-up. In contrast, an observed improvement in mental wellbeing (SWEMBS) was noted from baseline to midpoint, which remained stable until further increases were observed at the final follow-up. RCI analysis also demonstrated reliable and clinically significant improvements in mental wellbeing from baseline across all phases of the study**.** Overall, participant thirteen showed reliable increases in psychological distress alongside reliable improvements in mental wellbeing, again highlighting a contradictory response to the intervention.

Class attendance data revealed that participant thirteen practised yoga an average of 3 times per week, which is below the group mean of 3.7 times per week. In the qualitative data, they reported no barriers to engaging in the yoga practice. Despite the increases in distress seen within the quantitative data. They reported a positive experience of the intervention described yoga as “life changing”, stating it “transformed my physical and mental wellbeing. Participant thirteen also notes physical “reduced back pain” and “improved flexibility and balance”, and mental health benefits “reduced stress and anxiety”. However, like participant twelve, they also noted that they found “back bends” difficult but still ok and felt the “risk of injury” was the most unhelpful thing about yoga. Overall, while participant thirteen reported positive experiences and showed reliable improvements in wellbeing, these contrasted with increased distress and limited changes in psychological flexibility and self-compassion, again reflecting a mixed pattern of outcomes.

**3.2.14 Participant Fourteen.** Participant fourteen showed stable baseline data for psychological flexibility (CompACT-10) and self-compassion (SCS-SF). Visual analysis of psychological flexibility revealed no apparent shifts in level following the introduction of the intervention. However, a downward shift and variable data points were observed during the intervention phase. In the washout phase, there were no apparent shifts in level once the intervention had been withdrawn, followed by a slight downward shift with minimal variation. Half of the data points are above the trend line, and half are below, suggesting no clear trend; however, the effect size estimate (0.25) indicates a possible adverse effect. DC and RCI analysis suggest that reliable or systematic change

of psychological flexibility cannot be determined. Overall, this suggests the intervention's impact on psychological flexibility was potentially negative but inconclusive for participant fourteen.

For self-compassion, visual analysis revealed no clear changes in level following the introduction of the intervention, followed by a downward shift and then a slight upward trend. In the washout phase, there were no shifts in level after the removal of the intervention; subsequently, the data showed limited variability, indicating minimal changes. Based on the projected trend line, participant fourteen deteriorated more than would be expected in the absence of an intervention, and effect size estimates (0.0) suggest a strong adverse effect. This observation was supported by RCI calculations, which demonstrated a reliable reduction in self-compassion at the midpoint of the intervention. Furthermore, the DC analysis indicates systematic reductions in self-compassion during the intervention and washout phases, as none of the data points exceed both the trend and median lines**.** Overall, the intervention appeared to have a negative impact on self-compassion for participant fourteen.

Participant fourteen showed significant increases in psychological distress (DASS-21) at the midpoint, which reduced by post-intervention but was still elevated in comparison to baseline distress. Further increases in distress were seen at the first follow-up, and these reduced again by the final follow-up. This was supported by RCI calculations, which showed reliable and clinically significant increases in overall psychological distress from baseline across all phases of the study. There were also reliable increases in the anxiety subscale at the midpoint and in the stress subscale at the first follow-up. In contrast, an observed improvement in mental wellbeing (SWEMBS) was noted from baseline to midpoint. A decrease was observed at the post-intervention stage; however, increases were noted at the first follow-up, but these decreased again by the final follow-up. RCI analysis demonstrated reliable and clinically significant improvements in mental wellbeing at the first follow-up. Overall, participant fourteen showed a reliable increase in psychological distress alongside reliable improvements in mental wellbeing, again highlighting an inconsistent response to the intervention.

Class attendance data revealed that participant fourteen practised yoga an average of 3.5 times per week, which is slightly below the group mean of 3.7. In the qualitative data, they reported experiencing interruptions to their practice, which acted as a barrier to engagement. Participant fourteen reported physical and emotional benefits such as “improved balance” and “reduced stress and anxiety”. However, they reported experiencing pain and discomfort when practising yoga, and they reported that the study was “challenging yet rewarding”. Participant fourteens experience of pain may explain increases in psychological distress. However, overall, the intervention appeared to have an inconsistent impact on participant fourteen.

### *3.3 DASS Subscale Findings*

**3.3.1 Depression.** In the depression sub-scale of the DASS-21, most participants (71.42%) experienced no significant changes across the phases of the study (see Table 4). Two participants (P7 and P8) (14.28%) demonstrated reliable and clinically significant improvements at the midpoint of the intervention. In contrast, another two (P2 and P12) (14.28%) showed reliable and clinically significant worsening of depression at the intervention midpoint. For P2, this worsening of depression was maintained at the final follow-up (See Table 4).

Despite the hypothesis that participants would experience improvements in depression in response to the intervention, none of the participants experienced significant improvements in depression at the post-intervention point (See Table 4). Additionally, all participants showed no reliable positive or negative changes in depression at the post-intervention point.

These findings suggest that overall yoga, as practised in this study, had a limited impact on depression, as measured by the DASS-21. Although some participants experienced short-term improvements, an equal number experienced short-term deterioration, and most of these changes were not sustained through the intervention phase. The yoga intervention did not appear to consistently or reliably reduce depression symptoms within the sample.

In contrast, the qualitative data showed that, the participants who demonstrated a worsening of depression during the intervention both reported subjective benefits, such as “mental improvement” (P12) and “increased body awareness” (P2). However, in the weekly diary, P12 noted that they found the time commitment of the study difficult. In the CCI, they also noted that the intervention was “very long”, suggesting this client felt engaging in the study was burdensome, which may explain the increases in depression. Whereas P2 did not identify any barriers to practice but felt the most unhelpful thing about yoga for them was “physical discomfort” and “holding postures”, suggesting that they may have found the practice difficult, which may have contributed to the worsening of depression symptoms during the intervention phase.

Whereas the qualitative data for P7 and P8, who experienced improvements in depression, show that both reported no barriers to practising. In the CCI, they both reported experiencing a reduction in stress and anxiety, and “emotional release” from the practice. These subjective experiences may explain the reductions in depression observed in these two participants.

**3.3.2 Anxiety.** In the anxiety sub-scale of the DASS-21, eleven participants (78.57%) experienced no significant changes in anxiety across the phases of the study (see Table 4). Two participants (P7 and P8) (14.29%) showed reliable and clinically significant improvements in anxiety at the midpoint, and one participant (P14) (7.14%) showed a reliable and clinically significant worsening at the midpoint (See Table 4); however, none of these changes were maintained past this point.

In contrast to the hypothesis that participants would experience improvements in anxiety in response to the intervention, none of the participants experienced significant improvements or declines in anxiety at the post-intervention point (See Table 5). The findings suggest that the yoga intervention practised within this study did not have a significant impact on anxiety. Although there were some short-term changes in anxiety, none of these were maintained past the intervention midpoint.

Qualitative data show that P14 reported personal challenges and barriers to practice in the early stages of the intervention phase. In contrast to the

quantitative data, in the CCI P14 reported experiencing “reduced anxiety” in relation to the yoga intervention. The reported barriers and challenges may explain why P14 experienced increased anxiety at the midpoint of the intervention, but this then reduced as the study proceeded. In the CCI, the two participants (P7 and P8) (14.28%) who experienced short-term benefits both reported experiencing “reduced anxiety” in response to the yoga intervention. However, P7 reported that the “time commitment” required to take part was unhelpful, and they found it difficult to “adjust to different styles and the consistency of the practice”; they also reported dealing with “physical limitations”. Whereas P8 shared the most unhelpful thing about yoga for them was “the flexibility”. These perceived individual difficulties within the yoga practice may explain why positive changes were not maintained during the intervention phase.

**3.3.3 Stress.** In the stress subscale of the DASS-21, eight participants (57.14%) showed no significant changes across the study phases (see Table 4). Unexpectedly, five participants (35.71%) experienced reliable and clinically significant increases in stress; however, four of these five participants experienced increases in stress after the intervention had been withdrawn during the follow-up phase. Only one participant (7.14%) experienced a reliable and significant improvement in stress, which occurred at the midpoint but was not sustained throughout the intervention phase.

In contrast to the hypothesis that the yoga intervention would lead to reduced stress, none of the participants experienced significant improvements or declines in stress at the post-intervention point (See Table 5). The findings suggest that yoga, as practised within this study, did not have a significant impact on stress. Although there were some reliable increases in stress, many of these occurred five to six weeks after the intervention had been withdrawn and may be influenced by external factors unrelated to the intervention.

In contrast to the quantitative findings, the qualitative data revealed that the five participants who demonstrated increased stress all perceived yoga as a helpful tool for stress management. P6 stated that yoga “reduces stress”, P9 stated that yoga “helped in stress relief”, P13 and P14 reported “reduced

stress", and P8 shared "…yoga helped me reduce stress…leading to a calmer mental state". However, the one participant (P9) who experienced increased stress at the intervention midpoint shared that they felt yoga "…help me alleviate chronic pain and reduce tension…" but they also felt "the risk of injury" was unhelpful. The findings suggest that although yoga had a limited impact on stress, as indicated in the quantitative data, participants felt that yoga was a helpful stress management tool. Following the withdrawal of the intervention, stress levels increased, potentially suggesting that, rather than reducing stress, yoga helped protect against increases in stress in this study.

### 3.4 Client change interview

Framework analysis was utilised to organise and categorise the written responses from the client change interview (CCI). Below is a breakdown of the participants' responses to each question in the CCI.

#### *Q1 What has engaging in yoga been like for you?*

Half of the participants (50%) focused on physical benefits such as "improved flexibility" (P2, P13), "improved balance" (P5, P13), "pain relief" (P9), and "strength" (P4). P9 and P14 spoke more broadly about the overall benefits to physical health. Three participants (21.43%) reported emotional benefits, including "decreased stress and anxiety" (P6, P8), and felt that yoga provided a "safe space for emotional release" (P7). P8 felt the meditative aspect of yoga specifically helped to reduce their stress and anxiety. Two participants (14.29%) reported a positive experience (P1, P3), whereas P10 felt that engaging in yoga was "fun and stressful".

#### *Q2 What changes, if any, did you notice since engaging with yoga?*

Again, most participants (85.71%) focused on physical changes (P1, P2, P3, P4, P5, P6, P7, P9, P10, P11, P13, P14). Such as, getting stronger (P4, P9), "improved flexibility" (P2, P9), "pain relief" (P10, P13), "improved sleep" (P7), "improved balance" (P6, P14), "increased endurance" (P1), "weight loss" (P3) "improved posture" (P5), and improved "overall physical health" (P11). Two participants (14.29%) noticed emotional benefits, including "reduced stress and anxiety" (P8), and an overall improvement in mental health (P12).

***Q3 If you noticed changes, what do you think caused these changes?***

Most participants (64.29%) felt the changes were related to practising yoga consistently (P1, P2, P3, P6, P10, P11, P12, P13, P14). Two participants (14.29%) felt that the changes they observed were related to physical improvements in strength and flexibility (P4, P9), while another participant felt that the changes were related to “improved posture” (P5). Another felt changes were related to “decreased anxiety and stress” (P7).

***Q4 What was the most helpful thing about yoga?***

Five participants (35.71%) focused on emotional benefits (P2, P9, P11, P12, P13). Four participants (28.57%) stated that a reduction in stress and anxiety was the most helpful aspect of yoga (P2, P9, P11, P13); another participant reported that “improved concentration” was the most beneficial aspect for them (P12).

A further five participants (35.71%) reported that physical improvements were the most helpful aspect of yoga (P4, P5, P6, P7, P14). Two (14.29%) reported “improved flexibility” (P4, P14), one stated “pain relief” (P5), another stated “improved sleep” (P6), and one reported overall “improved physical health” (P7).

***Q5 What was the most unhelpful thing about yoga?***

Half of the participants (50%) identified the most unhelpful aspect as related to physical challenges (P2, P8, P9, P11, P12, P13, P14). Four participants (28.57%) felt that being at “risk of injury” through practising yoga was the most unhelpful thing (P9, P11, P12, P13), and another two (14.29%) noted “pain” and “physical discomfort” (P2, P14). One participant felt that the “time commitment” required to engage was unhelpful (P7). A further five participants (35.71%) felt there was “nothing” unhelpful about the yoga practice (P1, P3, P4, P5, P6, P10).

***Q6 Were there parts of the yoga that were difficult but still Ok or helpful?***

Four participants (28.57%) found mindfulness aspects (P4, P8, P9, P14) to be a challenging aspect of yoga, yet they still found it acceptable or helpful.

Notably, two of these participants specifically mentioned the difficulty with breathing (P4, P9). Three (21.43%) noted “holding poses” (P1, P2, P9), two (14.29%) noted “back bends” (P11, P13), and another mentioned “inversion” (P8), and another more generally noted “stretching” (P12). Another two (14.29%) felt that the consistency/duration of practice was difficult but still okay or helpful (P7, P3), and another mentioned “adjusting to different styles of yoga” (P7). One participant noted “physical limitations” (P7), and three (21.43%) did not mention any parts that were difficult but still Ok or helpful.

***Q7 Do you think anything was missing from the yoga practice?***

All participants felt that nothing was missing from the yoga practice.

***Q8 What has it been like for you to be involved in the study?***

Nine participants (64.29%) reported that being involved in the study was a positive experience for them (P1, P3, P5, P7, P8, P9, P10, P13, P14). Four (28.57%) described the study as a “good”, “great” or a “fun experience” (P1, P3, P9, P10), two (14.29%) felt they learnt from the study (P5, P8), and another felt the study was challenging but rewarding (P14). Two participants (14.29%) felt that the study had been impactful (P7, P13), and one of these participants noted that yoga had “transformed my physical and mental wellbeing” (P13). Two participants (14.29%) focused on physical benefits such as “physical growth” (P4) and “increased awareness of body mechanics” (P2). Three participants (21.43%) felt that being involved in the study was challenging, two (14.29%) felt the study was “lengthy” (P11, P12), and another reported “dealing with physical challenges” (P6).

***Q9, Do you have any suggestions around improving the intervention or the way the study was run?***

One participant (7.14%) suggested that the study's duration should have been shorter (P1); no other participants made suggestions (92.86%).

**Table 11**

*Client Change Interview Adapted (Elliott et al., 2001).*

| PP | Questions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1. What has engaging in yoga been like for you? | 2. What changes, if any, did you notice since engaging with yoga? | 3. If you noticed changes, what do you think caused these changes? | 4. What was the most helpful thing about yoga? | 5. What was the most Unhelpful thing about yoga? | 6. Were there parts of the yoga that were difficult but still Ok or helpful? | 7. Do you think there was anything missing from the yoga practice? | 8. What has it been like for you to be involved in the study? | 9. Do you have any suggestions around improving the intervention or the way the study was ran? |
| P1 | It has been really great | I gained endurance | Yoga | I exercise everyday | Nothing | Holding poses | No | A great experience | The time duration should be lesser |
| P2 | Increased flexibility | Improved flexibility | Regular stretching | Stress relief | Physical discomfort | Holding poses for a long time period | No | Increased awareness of body mechanics | No |
| P3 | A good experience | Weight loss | Yoga | Nothing | Nothing | Yes, the duration of yoga | No | A good experience | No |
| P4 | Enhanced strength | Stronger muscles | Strength building poses | Improved my flexibility | Nothing | Learning to breathe properly | No | Physical growth | No |

| PP | Questions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1. What has engaging in yoga been like for you? | 2. What changes if any did you notice since engaging with yoga? | 3. If you noticed changes, what do you think caused these changes? | 4. What was the most helpful thing about yoga? | 5. What was the most Unhelpful thing about yoga? | 6. Were there parts of the yoga that were difficult but still Ok or helpful? | 7. Do you think anything was missing from the yoga practice? | 8. What has it been like for you to be involved in the study? | 9. Do you have any suggestions around improving the intervention or the way the study was run? |
| P5 | Practising poses that require stability helps improve my physical balance and coordination | It has improved my posture | Improved posture | Pain relief | Nothing | No | Nothing | Learning new techniques | No |
| P6 | It reduces stress | It has enhanced my ability to maintain balance | Engaging regularly | A better sleep | None | No | No | Dealing with physical challenges | No |

| PP | Questions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1. What has engaging in yoga been like for you? | 2. What changes if any did you notice since engaging with yoga? | 3. If you noticed changes, what do you think caused these changes? | 4. What was the most helpful thing about yoga? | 5. What was the most Unhelpful thing about yoga? | 6. Were there parts of the yoga that were difficult but still Ok or helpful? | 7. Do you think there was anything missing from the yoga practice? | 8. What has it been like for you to be involved in the study? | 9. Do you have any suggestions around improving the intervention or the way the study was run? |
| P7 | Yoga provided a safe space for emotional release and self-reflection | Improved my sleep pattern and quality | It decreased stress and anxiety | It improved my physical health | Time commitment | Adjusting to different styles, physical limitations and consistency in practice | No | Amazing, it really has been impactful. | No |
| P8 | The meditative aspects of yoga has helped me reduce stress and anxiety, leading to a calmer mental state | It reduces stress and anxiety | Mindfulness practice that encourages focus on breath and the present moment | It has enhanced my mindfulness. | The flexibility | Inversion, emotional release and finding inner stillness | No | Educational, I have learnt a lot from this study | No |

| PP | Questions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1. What has engaging in yoga been like for you? | 2. What changes if any did you notice since engaging with yoga? | 3. If you noticed changes, what do you think caused these changes? | 4. What was the most helpful thing about yoga? | 5. What was the most Unhelpful thing about yoga? | 6. Were there parts of the yoga that were difficult but still Ok or helpful? | 7. Do you think there was anything missing from the yoga practice? | 8. What has it been like for you to be involved in the study? | 9. Do you have any suggestions around improving the intervention or the way the study was run? |
| P10 | Fun and stressful | Comfort | Commitment | Everything in it | Nothing | No | No | Fun | No |
| P11 | Fun | Improved physical health | Consistency | Reduced stress and anxiety | Injury risk | Back bends | No | Lengthy | No |
| P12 | Time commitment | Mental improvement | Consistency and regular exercise | I've been able to concentrate | Nothing maybe injury | Yes stretching | No | Very long | No |
| P13 | Improved flexibility and balance | Reduced back pain | Consistency | Reduced stress and anxiety | Injury risk | Back bends | No | Life changing, yoga transformed my physical and mental wellbeing | No |

| PP | Questions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1. What has engaging in yoga been like for you? | 2. What changes if any did you notice since engaging with yoga? | 3. If you noticed changes, what do you think caused these changes? | 4. What was the most helpful thing about yoga? | 5. What was the most Unhelpful thing about yoga? | 6. Were there parts of the yoga that were difficult but still Ok or helpful? | 7. Do you think there was anything missing from the yoga practice | 8. What has it been like for you to be involved in the study? | 9. Do you have any suggestions around improving the intervention or the way the study was run? |
| P14 | Physical benefits | Improved my balance | Regular practice | Reduced stress and anxiety | Pain and discomfort | Meditation, I guess | No | Challenging yet rewarding | No |

*Note.* Participant responses to client change interview adapted from Elliott et al. (2001) completed at the post-intervention point. Key, PP= participant.

# 4 Extended Discussion

## 4.1 Intervention Effectiveness

It was hypothesised that the participants would experience reduced psychological distress and improved mental wellbeing upon the completion of the yoga intervention. However, this was not the case for psychological distress, and participants experienced inconsistent and contradictory outcomes, with more participants demonstrating a deterioration than an improvement in psychological distress. In contrast, there were consistent improvements in mental wellbeing for the majority of participants. The outcomes of the current study appeared to reflect participants maintaining and improving mental wellbeing despite the presence and, at times, worsening of psychological distress.

Psychological distress was measured using the DASS-21, which is recognised as a validated self-report measure. The DASS-21 measures distress through the three domains of depression, anxiety, and stress. In this study psychological distress was operationalised as scoring between mild and moderate on one or more of the DASS-21 subscales (Lovibond & Lovibond, 1995). Mental wellbeing was measured using the SWEMBS, which is recognised as a validated self-report measure. The SWEMBS assesses wellbeing through domains of positive psychological functioning, including social connection, sense of purpose, positive energy, and optimism (Stuart-Brown et al., 2009).

The onset of reliable and clinically significant worsening in psychological distress did not occur immediately after the intervention was introduced. Across the sample, only two participants showed deterioration in psychological distress during the six-week yoga intervention, and none did so at the post-intervention point. The remaining five deteriorations occurred during the follow-up phase, which occurred four and six weeks after the intervention had been withdrawn. However, the improvements observed all occurred during the intervention

phase, with three participants showing improvements at the midpoint of the intervention and one demonstrating improvement at the end of the intervention.

Reliable and clinically significant improvements in mental wellbeing emerged quickly for most participants. Six of the nine improvers achieved reliable changes in mental wellbeing by the midpoint, and another demonstrated these positive changes by the post-intervention point. The remaining two participants appeared to show a delayed effect, and they demonstrated changes during the follow-up phase, which was four and six weeks after the yoga intervention had been withdrawn. Additionally, the one participant who experienced clinically significant and reliable worsening of mental wellbeing did not show changes until the follow-up period. These delayed changes suggest that the outcomes observed may have been influenced by external factors rather than the yoga intervention.

## 4.2 Overall Findings in Relation to ACT Theory

To understand how mental wellbeing can improve while symptoms are present and even increasing, the findings can be considered in relation to ACT theory, which explicitly separates psychological wellbeing from the absence of mental health symptoms (Hayes, 2006). Despite the inconsistency of changes in psychological distress, the repeated presence of improvements in mental wellbeing across participants meets the standards of demonstrating replication in SCED (Kratochwill et al., 2010), suggesting that the yoga intervention was clinically effective in supporting wellbeing.

According to ACT, psychological flexibility is the central mechanism of change that allows individuals to engage more fully with the present and act in line with personal values, even in the presence of distressing thoughts or emotions (Hayes et al., 2006; Kashdan & Rottenberg, 2010). In this sense, reductions in distress are not necessary for improvements in wellbeing to occur. The current findings, in which participants often reported enhanced wellbeing despite stable or increased symptoms of distress, are consistent with this concept. It is possible that yoga practice promoted processes such as mindfulness, interoceptive awareness, and acceptance, which enhanced

participants' capacity to connect with valued aspects of life and to perceive psychological benefits, even in the absence of reliable symptom reduction.

This interpretation is also supported by qualitative data, which showed that participants experiencing increased distress often still described psychological or physical benefits from the intervention, including stress relief, improved sleep, or reduced pain. Within the ACT framework, these accounts suggest that yoga may have enabled participants to experience valued outcomes while also enduring ongoing discomfort. This finding is consistent with previous ACT-based research, which has shown that improvements in quality of life and valued living can emerge independently of, or prior to, reductions in distress (Grégoire et al., 2020; Wersebe et al., 2018).

The pattern observed within the current study also highlights the functional variability of yoga across individuals. For some, yoga may have supported adaptive processes that increased resilience and wellbeing; for others, the practice may have heightened awareness of distressing experiences, contributing to symptom increases.

Taken together, these findings suggest that the yoga intervention did not effectively reduce psychological distress but may have promoted processes consistent with ACT's conceptualisation of wellbeing as values-based living in the presence of symptoms. This distinction underscores the importance of assessing both distress and wellbeing outcomes when evaluating psychological interventions, as clinically meaningful improvements may occur even in the absence of symptom reduction.

### 4.3 Findings in the Context of Mechanisms of Change in Yoga Research

The current study was designed and developed based on the findings of existing research into the MOC in yoga. It was expected that distress would decrease through engagement in the yoga intervention, via increases in the proposed MOC (psychological flexibility and self-compassion). However, the findings did not support this hypothesis, and several participants experienced increased psychological distress, and limited changes occurred in the proposed MOC.

Psychological flexibility and self-compassion were examined as potential mechanisms of change within this study. The overall outcomes indicated that three participants experienced improvements in psychological flexibility, three experienced decreases, and the majority showed little or no observable change. For self-compassion, most participants remained stable, but four experienced reductions, with no participants demonstrating consistent improvements. These patterns suggest that, within this sample, the yoga intervention was not reliably associated with increases in either psychological flexibility or self-compassion.

These findings contrast with much of the existing yoga literature, where both psychological flexibility and self-compassion are frequently reported as processes underpinning positive outcomes (Avery et al., 2018; Dick et al., 2014; Fox et al., 2024; Gard et al., 2012; Gorvine et al., 2019). Cross-sectional evidence has indicated that yoga practitioners tend to report greater psychological flexibility (Fox et al., 2024) and self-compassion (Gorvine et al., 2019), while experimental studies have suggested that yoga-based programmes can enhance these processes. The current findings diverge from this broader pattern, raising questions about the conditions under which yoga supports these mechanisms.

One possible explanation relates to the procedures emphasised in the intervention. Fox et al. (2024) highlighted that changes in psychological flexibility were most strongly associated with the yoga limb of ethical guidance (*yama*), in addition to physical postures (*asana*). In contrast, the present intervention emphasised physical postures, breathing, and meditative focus, without explicit values-based or ethical guidance components. From a process-based perspective, this may have limited opportunities for participants to develop the elements of psychological flexibility, such as values clarity and committed action (Harris, 2019). Similarly, without explicit emphasis on compassionate practices, yoga may not have sufficiently targeted the self-kindness and common humanity dimensions that underpin self-compassion (Neff, 2009).

Another consideration is the heterogeneity of individual responses. The mixed outcomes suggest that for some participants, yoga may have supported

adaptive processes that improved psychological flexibility. In contrast, for others, practice may have inadvertently worsened self-critical tendencies or experiential avoidance. Qualitative data provide some support for this interpretation. Participants who reported decreases in psychological flexibility or self-compassion often described positive physical or psychological benefits from yoga. However, some also reported challenges such as pain, discomfort, or interruptions to practice. These contextual factors may have shaped how yoga functioned for each individual. For example, some participants may have primarily framed their engagement with yoga in terms of reducing pain or distress. In this sense, it may have acted as a control strategy rather than fostering openness and acceptance (Hayes-Skelton & Eustis, 2020), thereby limiting increases in psychological flexibility or self-compassion.

These findings are consistent with broader critiques of the MOC literature in yoga, which has been described as conceptually fragmented and methodologically inconsistent (Matko et al., 2021; Riley & Park, 2015). Across studies, mechanisms such as mindfulness, self-compassion, and psychological flexibility are frequently presented as both outcomes and processes, and interventions vary widely in their inclusion of philosophical, ethical, or meditative components. This has made it difficult to identify consistent yoga styles, class durations, or overall intervention lengths that are associated with positive outcomes. The current study extends this literature by conducting a more rigorous and controlled study. However, the outcomes suggest that yoga, as practised in the study, did not lead to reliable or consistent improvements in psychological flexibility or self-compassion, and the outcomes appeared to be more individualised than expected. In contrast to the existing literature, for some, engaging in the intervention was associated with deterioration in self-compassion.

Taken together, these results suggest that the positive effects of yoga observed on wellbeing in this study were not consistently mediated by psychological flexibility or self-compassion. Instead, other processes, such as mindfulness, interoceptive awareness, or physical improvements, may have played a stronger role. This finding underscores the importance of considering individual variability in how participants engage with and respond to yoga. It

also suggests that interventions may need to be more explicitly designed to facilitate the development of compassion and values-based engagement to create changes in these variables.

### 4.4 Discrepancies Within the Findings

A notable feature of the current study was the contrast between quantitative and qualitative outcomes. While the quantitative measures suggested limited and, at times, detrimental effects of yoga on psychological flexibility, self-compassion, and psychological distress, participants overwhelmingly reported positive experiences of the intervention. In the CCI, participants described yoga as helpful for reducing stress, enhancing mindfulness, improving sleep, alleviating pain, and fostering physical strength and balance. Even those who demonstrated deteriorations on quantitative measures often reported benefits, describing the intervention as “transformative,” “impactful,” or “a great experience.” (See Table 11).

This discrepancy may reflect differences in what was being measured. Standardised scales are designed to capture shifts in specific constructs, but may not fully reflect the broader, subjective benefits that participants associated with their yoga practice. It is also possible that yoga supported outcomes not directly assessed by the measures used, such as increased interoceptive awareness, improved body image, or feelings of connection (Cox & Tylka, 2020; Park et al., 2021). Given that the study took place during a period of academic pressure (Fritz et al., 2021; George, 2024), including end-of-year assessments, yoga may not have reduced distress scores; however, it may have acted as a buffer, preventing greater deterioration over time.

Taken together, the findings highlight the importance of integrating quantitative and qualitative data when evaluating interventions such as yoga. While quantitative outcomes provide evidence of measurable change in targeted constructs, qualitative reports offer valuable insight into participants lived experiences, capturing benefits that may not be reflected in symptom scores alone.

### 4.5 Cultural and Gender Considerations

A distinctive strength of the present study was the demographic profile of the sample. This stands in stark contrast to much of the existing literature and offers an important contribution, as it provides insight into how yoga may be experienced by groups who are typically underrepresented in research.

The over-representation of white women in existing yoga studies raises questions about the extent to which findings can be generalised across different cultures and genders. Cultural perceptions of yoga, gender norms, and historical exclusion from wellness spaces are all likely to shape engagement and receptivity to yoga (Cagas et al., 2021; McIver et al., 2021; Spadola et al., 2017). For example, men are often less likely to engage in yoga due to stereotypes that frame it as feminine or incompatible with traditional male identities (Cagas et al., 2024). However, the findings of this study challenge these assumptions. Not only did men participate in the intervention, but many also reported both physical and psychological benefits, suggesting that when yoga is delivered in an accessible format, it can appeal to groups who are often considered harder to reach. The online delivery method may have reduced some of the barriers associated with attending in-person classes, making yoga feel more approachable and less stigmatised.

Similarly, the high proportion of participants from racially minoritised backgrounds is significant given the lack of representation of these groups in yoga research. Wellness spaces in Western contexts have been criticised for reproducing exclusionary practices, where people of colour often feel underrepresented or unwelcome (Robinson et al., 2023). The present study demonstrated that students from a range of ethnic backgrounds engaged with the intervention, suggesting that yoga, when delivered in a more accessible way, has the potential to reach groups who are often marginalised in research and practice. This is particularly important in the university context, where racially and ethnically minoritised students are more likely to experience poor mental health than white students and are less likely to seek support (Olaniyan, 2021). Olaniyan (2021) also found that racially and ethnically minoritised students reported higher levels of isolation and discrimination, alongside having

access to fewer support systems which they felt were suitable for their needs, highlighting the importance of developing interventions that feel inclusive and relevant to diverse student populations.

The demographics of the sample may also help to explain why the findings diverged from much of the established literature. Cultural and gendered identities can shape not only how participants engage with yoga but also how they experience and interpret its benefits. For example, some participants described yoga as helpful despite quantitative outcomes indicating deteriorations in psychological flexibility or self-compassion. This may reflect differences in expectations of yoga, variations in the ways benefits are valued, or differences in how psychological change is expressed across cultural groups.

Taken together, the findings underscore the importance of considering cultural and gender aspects when evaluating yoga as a psychological intervention. The findings suggest that yoga, as practised in this study, has the potential to engage racially minoritised male students when offered in accessible online formats, challenging existing findings that yoga is primarily of interest to white, middle-class women. At the same time, the findings highlight the need for culturally adapted and gender-sensitive approaches that actively address barriers to participation, enhance feelings of representation and safety, and ensure that yoga interventions are accessible and inclusive for all.

### 4.6 Research Limitations

Several limitations should be acknowledged when interpreting the findings of this study. First, although the single-case experimental design (SCED) offers valuable insights into within-person change, causal inference is limited by the missing data points during the intervention phase. Weeks three and six of the process measures were not administered, reducing the number of repeated assessments available to establish trends. In the planning stages of the research, it was decided to collect six data points in the intervention section to optimise the ability to detect a reliable treatment effect in the intervention phase (Smith, 2012). The omission of these measures resulted in only four data points being collected during this phase, which weakened the ability to assess the intervention's impact. Despite this, having four data points still meets the

acceptable standard for SCED as outlined by the What Works Clearinghouse (WWC), which states that a study must include three attempts to demonstrate an intervention effect at three different points in time (Kratochwill et al., 2010). However, this error in the data collection weakened the study's ability to determine change using Fisher's Dual Criteria (DC) method, as Fisher et al. (2003) recommend a minimum of five data points in an intervention phase to use the criteria. As five data points in the intervention phase were not available in the current study, the DC method relied on data points from both the intervention and washout phases. However, to compensate for the weakness of applying the DC method to the data, additional methods such as visual analysis and the percentage of data exceeding the median (PEM) effect size calculation (Lane & Gast, 2014; Ma, 2006) were employed. However, the PEM method has its limitations. It has been criticised for inflating effect sizes as a strong positive or negative effect could be determined if data points are just slightly above or below the median line (Ma, 2006).

Another methodological limitation within the study was the lack of stability achieved within the baseline phase. SCED research suggests extending the baseline phase until stability is achieved (Smith, 2012). The current study was advertised to students experiencing psychological distress who were interested in participating in yoga to improve their wellbeing (Appendix E). It was felt that withholding the intervention for longer than four weeks may have been unethical. The DC method accounts for instability within the baseline phase by using a trend line to project the participant's expected direction of change; however, the PEM method does not account for trends. Therefore, a combination of visual analysis, effect size estimates, and the DC method was employed to address these limitations of the missing data points and unstable baseline data.

Another limitation was the practical context of recruitment and delivery. Participants were primarily recruited through social media, which likely attracted a self-selecting group of students who were already motivated to try yoga as an alternative method for improving their wellbeing. While this facilitated recruitment and led to a surge of interest, it also narrows the representativeness of the sample and creates a bias of selection effects (Park et al., 2015).

Additionally, the online delivery of the intervention may have limited participants' engagement with the practice. The yoga intervention was provided through a single pre-recorded video and practised at home in unsupervised environments. Although this maximised accessibility and feasibility, it reduced researcher control over how the intervention was implemented. Adherence was monitored using participant codes, but this does not necessarily reflect the quality or depth of participants' engagement. Similarly, the absence of live instruction meant that safety checks and posture corrections were not possible, which may have affected both the integrity and impact of the practice. Furthermore, the intervention video used emphasised physical postures, breathwork, and meditative focus, but did not incorporate explicit yoga philosophy or ethical guidance. Previous studies suggest that such components are important in cultivating psychological flexibility and self-compassion (Avery et al., 2018; Dick et al., 2015; Fox et al., 2024; Gard et al., 2014). The lack of focus on these limbs of yoga may help explain why these mechanisms of change did not shift as strongly as anticipated in the present study.

### 4.7 Clinical and Future Research Implications

In the current study, yoga was not universally beneficial in reducing symptoms of psychological distress. For some participants, distress increased despite most reporting improved wellbeing. These findings contrast with much of the existing literature, which has often reported consistent symptom reduction following yoga. The findings highlight the need to extend research to populations beyond the predominantly white female samples that characterise most yoga studies. By chance, participants in the current study were predominantly men from racially minoritised backgrounds, and future research should deliberately focus on recruiting underrepresented groups and developing culturally adapted yoga interventions to understand yoga's impact within these populations better (Cagas et al., 2024).

Clinically, the findings suggest that caution may be required when recommending yoga as an intervention for psychological distress (Cramer et al., 2019). Outcomes appeared more complex and individualised than previously assumed. Nevertheless, yoga may have value as a preventive or adjunctive

treatment that supports mental wellbeing. Assessing both physical and psychological readiness prior to engagement is likely to be important in ensuring safe and beneficial outcomes.

From a methodological perspective, the findings provide support for the use of SCEDs in yoga research, given the high levels of individual variability observed. However, future research could strengthen this approach by establishing greater baseline stability before introducing the intervention and by collecting more data points within the intervention phase to enhance analytical power. In addition, the inclusion of more detailed qualitative methods would provide richer contextual information about unexpected changes in outcomes. This may help clarify how individual differences and external factors contribute to variable responses.

The lack of consistent positive changes in the proposed mechanisms of psychological flexibility and self-compassion also contrasts with prior research. One explanation may be that yoga, as practised in this study, may have been insufficient in terms of content, duration, or format to target these processes effectively. Future research could build on the present study by trialling longer interventions that incorporate a wider range of yoga practices, including ethical and philosophical elements, and by using more sensitive or yoga-specific measures of psychological change.

Finally, while the current findings suggest that the online delivery format used in this study was appealing and acceptable to a diverse group of participants, live online classes may increase emotional engagement and provide opportunities for tailoring through interaction with the teacher. Future studies could explore whether different delivery modes differentially impact outcomes and mechanisms of change.

## 5 Critical Reflection

Here, I offer my personal reflections on the research process, including how the research project was selected and developed, the challenges I faced, and how I overcame them. The strengths of the study, and what I have gained personally and professionally from undertaking the project.

Early into starting the doctorate course, our cohort was presented with a list of potential research projects to consider for the thesis. I was instantly drawn to a project on the list about yoga, as I have been practising yoga for around three years and have felt personal benefits in doing so. Firstly, I felt it would be interesting to explore one of my own hobbies in more detail, and I was passionate about expanding my knowledge of yoga to enhance its clinical applications. Secondly, I was drawn towards exploring potential self-help resources for students. As a student myself, I understand how academic pressures can impact mental health and how preventative self-help may be beneficial for those who struggle to access support. Within the epistemological stance of critical realism, it is essential to acknowledge my bias towards yoga in relation to this project, stemming from my personal experiences and interests.

The project idea initially focused on exploring how different components of yoga (physical posture, mindfulness, and breathwork) affected psychological distress and, if so, what mechanisms of change underpinned that change. The research was also first presented as a group comparison design. I attended research panels and presented the initial research proposal. The panel felt that the mechanisms of change research were still in their early stages and may benefit more from a single-case approach. It was also felt that splitting the limbs of yoga into three groups may be overly ambitious for a thesis project. Due to this feedback, revisions were made, resulting in the decision to use a SCED and evaluate yoga as a practice that incorporates the components of physical postures, breathwork, concentration, and mindfulness. Although the research panel and supervision team believed this approach would simplify the study, I felt overwhelmed by the prospect of applying a research methodology I had not used before. Support from supervisors and key readings helped me gain confidence in applying SCED, and I began to see how it could provide a more rigorous and appropriate way to answer the research questions proposed.

Designing a study to meet SCED requirements presented some practical challenges. To meet design criteria, I realised that at a minimum, my study would consist of sixteen weeks to meet criteria (four weeks baseline, six weeks intervention, 4 weeks washout, and two weeks follow-up). At this stage, I felt that the recruitment and retention of participants in my study might be

challenging due to the expected length of engagement time and the target population, which includes students with academic responsibilities in addition to their participation in the study. The research team and I considered how to reduce the burden on participants involved in the study. We selected shorter versions of the measures for repeated administration and compensated participants for their participation in the study. However, I remained concerned about the feasibility of retaining student participants over a prolonged period.

After setting up the survey and recruiting participants, I noticed a lack of uptake, despite sharing the study on a dedicated social media page. However, after sharing my study on a student research participation page, I noticed a significant surge in recruitment a few days later. I contacted my supervisors and closed recruitment at this point. I felt relieved that my study had gained participants and glad that people were interested in taking part. However, this also created additional and unanticipated workload in setting up and managing the weekly administration of the measures. Errors made during this process included the omission of process measures from some survey links and the inclusion of one participant who met exclusion criteria. I felt disappointed upon noticing these mistakes, which highlighted the challenges of managing a complex study under time pressure. These experiences reinforced the importance of careful monitoring, piloting, double-checking procedures, and being transparent about errors in supervision.

Using a SCED design ultimately proved to be highly valuable for this study. The approach enabled detailed case-level insight, which was particularly important given the variability of participant responses. From a critical realist perspective, the mixed outcomes observed across measures and individuals underscore the complexity of psychological change and the necessity of attending to both improvements and deteriorations, rather than assuming overall benefits from yoga. The richness of the individualised data provided a more nuanced understanding of how yoga may function as an intervention for students. It allowed me to examine patterns that would not have been visible in a group comparison design.

However, the methodology also presented challenges in its practical application. The length and structure of repeated measurements placed a significant administrative burden on me as a researcher and on participants. Errors in the administration of survey links led to the omission of important process data, which weakened the overall analysis and limited the conclusions that could be drawn about potential mechanisms of change. While these errors reflect my own developing research skills, they also highlight the practical challenges of implementing SCED rigorously. This experience reinforced the importance of careful attention to detail in data collection procedures and ongoing monitoring of the data being collected.

Despite the challenges, the project also exhibited several notable strengths. A key strength was the recruitment of participants from racially minoritised backgrounds, which helped to extend the evidence base of yoga interventions to an under-represented population. The qualitative feedback highlighted that participants valued the intervention and found both the format and delivery to be acceptable and feasible. Another unexpected positive was the level of uptake and retention, which exceeded my initial expectations given the length and demands of the study. The SCED design, while initially daunting, allowed for more nuanced insights into the individualised responses to yoga. This level of detail demonstrated the heterogeneity of effects, as while most participants reported improvements in mental wellbeing, psychological distress often showed little change or even deterioration. Psychological flexibility outcomes varied between improvement and deterioration, and self-compassion tended to remain stable, although some participants showed a decline. These findings highlight both the potential benefits of yoga for some individuals and the importance of recognising variability in response.

The process of completing this project has provided me with important learning opportunities as both a researcher and a developing clinical psychologist. One key personal area of development was around data organisation and management. The length and intensity of the study required me to manage multiple measures and weekly time points. Although I made errors, I learned the value of careful monitoring and clear tracking systems. I also recognised the importance of being open about mistakes and actively

seeking guidance from supervisors rather than attempting to resolve difficulties in isolation. This has helped me to develop confidence in asking for help and to view errors as a natural part of the research process rather than something to conceal.

Personally, I believe that my resilience has grown throughout the project. At several stages, I felt overwhelmed by the demands of recruitment, data management, or methodological challenges, but I was able to overcome each obstacle and maintain momentum. I also developed confidence in applying a methodology that was initially unfamiliar to me. I now feel competent in using SCED, creating and interpreting graphs, and applying a range of analytic strategies to evaluate data. These experiences have strengthened my confidence in conducting research more broadly and highlighted the importance of perseverance and maintaining self-belief.

**Portfolio word count: 31380**

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## Extended Appendices

### Appendix A

*Ethical Approval Letter*




Health and Clinical Neurosciences Research Ethics Sub-Committee

11/01/2024 Mental

Supervisor: David Dawson

Applicant: Natasha Bloor

Project: 3154Online Yoga for Students Experiencing Distress: A Single Case Experimental Design into the Psychological Mechanisms of Change.

The committee is pleased to confirm that the above study now has approval on the basis of your application and any subsequent clarifications. You must conduct your research as described in your application, adhere to all conditions under which the ethical approval is granted, and use only materials and documentation specified in your application.

If you need to make any changes (for example to extend your data collection timeframe, change the mode of data collection, or the measures being used), you must create and submit an Amendment Form. To do this, select the 'Create Sub Form' option from the Actions Menu on the left-hand side of the page in the online system and then select 'Amendment Form'.

With best wishes

Dr Katy Jones and Dr Jen Yates

Chairs of the Mental Health and Clinical Neurosciences Research Ethics Sub-Committee.

**Appendix B**

*Debrief Sheet*




**Participant Debrief Sheet**

**Date: 05/1/2024 Version Number: 2**

**Title of Study:** Online Yoga for Students Experiencing Distress: A Single Case Experimental Design into the Psychological Mechanisms of Change

**Name of Researchers:** Natasha Bloor, Dr Hannah Merdian, Dr Dave Dawson and Dr Sharron Smith

**Contact Details of Researchers:**

Lead researcher Natasha.Bloor@nottingham.ac.uk

Primary Research Supervisor Hmeridan@lincoln.ac.uk

Secondary Research Supervisor ddawson@lincoln.ac.uk

Field Research Supervisor shsmith@lincoln.ac.uk

We'd like to thank you for showing an interest in the research and taking part in the screening stage of the study, however, we would like to inform you that you are not eligible to take part in the rest of the study.

**Why am I not eligible to take part?**

This could be because you are already participating in regular yoga practice or regular psychological treatments. Alternatively, it could be because the answers you provided in the screening questionnaire indicated that you are either

below the threshold for moderate-severe depression, anxiety, or stress or above the threshold.

**What was the aim of the study?**

The aim of the study was to explore what changes occur in relation to yoga practice which leads to the reductions in distress and improvements in wellbeing, and to assess the effectiveness and utility of an online yoga intervention for students who are distressed.

**Questions**

If you have any further questions about the study, please feel free to email the lead researcher (NB) or their supervisor at any time on the email addresses above.

Further help and support

You may wish to seek support for your mental health and you can do this by contacting your GP to arrange an appointment. Alternatively, you may wish to seek support through your university's wellbeing services, if you are not a student at the university of Nottingham or Lincoln please contact the student wellbeing service at the university you attend.

University of Nottingham Counselling service counselling.service@nottingham.ac.uk

University of Lincoln Support Service studentsupport@lincoln.ac.uk

You may also wish to seek support through the Samaritans who are available 24/7 and can be contacted for free on 116 123 or via email: jo@samaritans.org. Here is a link to the website for further information on how to contact a Samaritan Contact Us | Samaritans

If you have any ethical concerns regarding the current research, your treatment as a participant or your involvement in the study please feel free to contact research-ethics@nottingham.ac.uk

# Appendix C

## *Weekly diary*

*Weekly Diaries*

| Item | Question | Options | |
|---|---|---|---|
| 1 | How many times did you practice the intervention this week?<br><br>*Please provide any additional information regarding how many times you practiced?* | Six-Seven<br>Five- Six<br>Three-Four<br>One-Two<br>Zero<br>Other | |
| 2 | Did you encounter any personal challenges that got in the way of you practicing?<br><br>*If yes, please provide information about challenges?* | Yes<br>No | Injury<br>Workload<br>Illness<br>Time<br>Other |
| 3 | Were there any external barriers that effected your practice this week?<br><br>*If yes, please provide information about barriers?* | Yes<br>No | Noise<br>Distractions<br>Interruptions<br>Connection or video issues<br>Other |
| 4 | Did you practice any other yoga apart from the video?<br><br>*If yes, please provide information about the yoga practice you completed?* | Yes<br>No | Self-practice<br>Attended an in-person class<br>Alternative online yoga<br>Other |
| 5 | Is there anything else you wish to add regarding your practice this week? | | |

*Note.* Weekly diary items that participants will complete during the intervention phase

## Appendix D

### *Client Change Interview*

*Client change survey*

| Item | Question |
|---|---|
| 1. | What has engaging in yoga been like for you? |
| 2. | What changes if any did you notice since engaging in yoga? |
| 3. | If you noticed changes, what do you think caused these changes? |
| 4. | What has been the most helpful thing about yoga? |
| 5. | What has been the most unhelpful thing about yoga? |
| 6. | Were there parts of the yoga that were difficult but still Ok or helpful? |
| 7. | Do you think there was anything missing from the yoga practice? |
| 8. | What has it been like for you to be involved in the study? |
| 9. | Do you have any suggestions around improving the intervention or the way the study was ran? |

## Appendix E

*Demographic Questions*

3) What is your age?

4) What gender describes you?

-Male

-Female

-Non-binary

-Prefer not to say

-Self describe (text box)

3) What is your ethnicity?

-self-describe (text box)

4) What year of university are you currently in?

-Foundation year

-First year

-Second year

-Third year

-Other (text box)

5) Do you have any disabilities?

-Yes (free text box to provide further information about the impact of disability)

-No

# Online Yoga for Students Experiencing Distress: A Single Case Experimental Design into the Psychological Mechanisms of Change

**Natasha Bloor, Dr Hannah Meridan, Dr David Dawson, Dr Sharron Smith**
Trent Doctorate in Clinical Psychology
The University of Nottingham | UNIVERSITY OF LINCOLN

## Introduction

- Rates of mental health difficulties in university students are rising, representing an important public health issue (Oswalt et al., 2020).
- Demand for university counselling services has increased, with long waiting times and barriers to help-seeking (Broglia et al., 2018).
- Online self-help is widely offered and has shown promise (Charbonnier et al., 2022)
- Yoga is a popular, low-cost mind–body practice that has been shown to improve well-being, reduce distress, and is feasible to deliver online populations (Brinsley et al., 2021)
- However, the **mechanisms of change (MOC)** in yoga remain unclear, limiting its clinical application (Riley & Park, 2015).
- Evidence suggests psychological flexibility and self-compassion may be key processes linking yoga practice to improved mental health (Gard et al., 2012; Fox et al., 2024).
- Clarifying these mechanisms will strengthen the evidence base and inform how yoga may be used as a precise, evidence-based self-help tool for students.

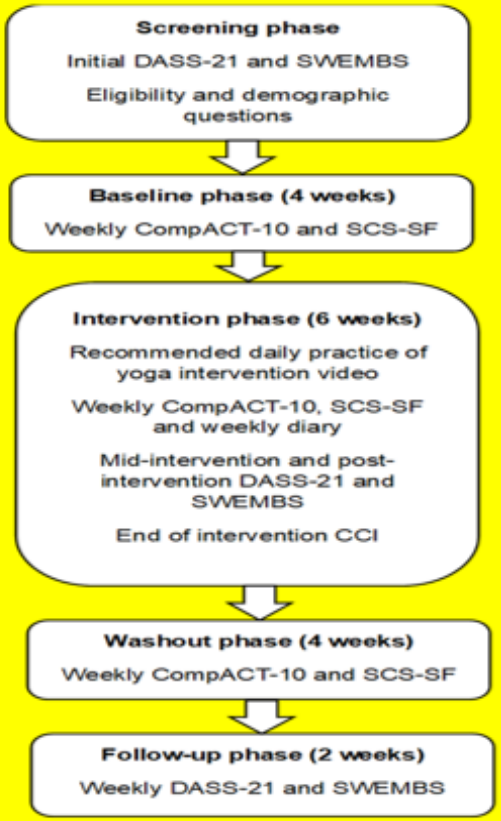
## Aims

**1)** Examine whether a six-week online yoga intervention effectively reduces psychological distress and improves mental well-being in university students

**2)** Explore whether **psychological flexibility** and **self-compassion** function as MOC that underpin positive outcomes.

## Method

This exploratory study utilised a mixed methods multiple single-case experimental design (n=14).




## Results

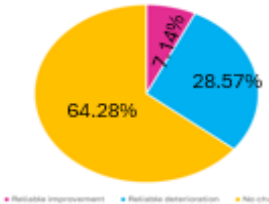
**Psychological Distress**
4 participants showed **reliable and clinically significant worsening** and 1 showed **reliable improvement** at post-intervention.

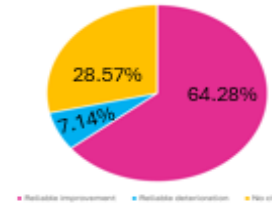
**Emotional Well-being**
9 participants showed **reliable improvements** at different phases of the study and 1 showed **deterioration.**

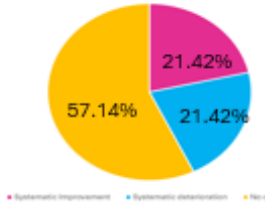
**Psychological Flexibility**
3 participants **systematically improved,** 3 **worsened**. Replication across cases (SCED criteria) for both improvement and deterioration.

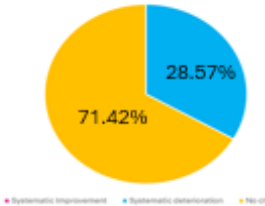
**Self-Compassion**
Most showed **no significant change** and 4 showed **deterioration.**

**Qualitative data**
Despite limited or negative quantitative outcomes, participants reported **perceived benefits.**




## Discussion

- The online yoga intervention led to improved well-being for students but did not consistently reduce distress; in some cases, distress worsened.
- Changes in psychological flexibility and self-compassion were inconsistent, with variable individual responses, suggesting these mechanisms may not change uniformly within short online interventions. However, participants reported meaningful subjective benefits (stress relief, mindfulness, physical health) that were not captured by standardised measures.
- Cultural and individual factors (e.g., diverse, male, racially minoritised sample) may have shaped engagement and contributed to varied outcomes.
- Overall, yoga may support wellbeing in students; it should not be assumed to be a universal solution for distress, emphasising the importance of context and individual differences.
- Recommendations: Yoga interventions should adopt a tailored approach that carefully adapts the practice to suit individuals' abilities and goals for practice.



*Note.* n: number; DASS-21. DASS-21: Depression, Anxiety, Stress Scale; SWEMBS: Short Warwick Edinburgh Emotional Wellbeing Scale; CompACT-10: measure of Psychological Flexibility; SCS-SF: Self-Compassion Scale-Short Form; CCI: Client Change Interview. *References:* Brinsley, J., Schuch, F., Lederman, O., Girard, D., Smout, M., Immink, M. A., Stubbs, B., Firth, J., Davison, K., & Rosenbaum, S. (2021). *Effects of yoga on depressive symptoms in people with mental disorders: A systematic review and meta-analysis*; Broglia, E., Millings, A., & Barkham, M. (2018). Challenges to addressing student mental health in embedded counselling services: a survey of UK higher and further education institutions. *British Journal of Guidance & Counselling*, *46*(4), 441-455.; Charbonnier, E., Trémolière, B., Baussard, L., Goncalves, A., Lespiau, F., Philippe, A. G., & Le Vigouroux, S. (2022). Effects of an online self-help intervention on university students' mental health during COVID-19: A non-randomised controlled pilot study. *Computers in Human Behavior Reports*, *5*, 100175.; Fox, N., Merwood, A., Gleeson, H., & Bennetts, A. (2024). *Could Yoga Improve Psychological Flexibility? A Cross-Sectional Study Exploring the Limbs of Yoga, Psychological Wellbeing and Psychological Flexibility* (SSRN Scholarly Paper No. 5023507). Social Science Research Network.; Gard, T., Brach, N., Hölzel, B. K., Noggle, J. J., Conboy, L. A., & Lazar, S. W. (2012). Effects of a yoga-based intervention for young adults on quality of life and perceived stress: the potential mediating roles of mindfulness and self-compassion. *The Journal of Positive Psychology*, *7*(3), 165-175.; Oswalt, S. B., Lederer, A. M., Chestnut-Steich, K., Day, C., Halbritter, A., & Ortiz, D. (2020). Trends in college students' mental health diagnoses and utilization of services, 2009–2015. *Journal of American college health*, *68*(1), 41-51.; Riley, K. E., & Park, C. L. (2015). How does yoga reduce stress? A systematic review of mechanisms of change and guide to future