Effects of a Digital Acceptance and Commitment Therapy (ACT)-based Intervention Course on Psychological Flexibility and Mental Health among University Students

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Tiivistelmä - Referat – Abstract

Globally, the mental health of university students is a critical issue. This population has an increased risk for mental health concerns due to a multitude of psychosocial and economic stressors. Digital psychological interventions, particularly those based on Acceptance and Commitment Therapy (ACT) have shown potential in supporting psychological flexibility and mental health. This study aims to examine the effect of a digital ACT-based intervention course on the psychological flexibility and mental health of university students, measuring mental well-being, anxiety, depression, and loneliness.

The sample of this research is 98 university students aged (21-52) enrolled in the digital ACT-based intervention course "*Towards Better Well-being and Studying*" at the University of Helsinki, during the autumn semester of 2022. These participants completed five questionnaires before and after the intervention to assess their psychological flexibility and mental health: the Work-related Acceptance and Action Questionnaire (WAAQ), the Short Warwick Edinburgh Mental Well-being Scale (SWEMWBS), the Generalized Anxiety Disorder 7-item scale (GAD-7), the Patient Health Questionnaire (PHQ-9), and the short-form UCLA Loneliness Scale (ULS-8).The effectiveness of this intervention course was analyzed using repeated measures t-tests to compare pre- and post-intervention responses.

Upon completing the intervention course, students displayed significantly enhanced psychological flexibility and reported improved mental health, characterized by elevated mental well-being, along with reduced anxiety and loneliness. No significant change was noted in depression levels. In conclusion, these findings support the efficacy of digital ACT-based intervention courses in enhancing the psychological flexibility and mental health of university students. They also highlight the pivotal role of educational institutions in promoting mental health and delivering psychological support to their students. Future research with larger sample sizes, randomized controlled trials (RCTs), and longitudinal follow-up studies is recommended.

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Keywords
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1 Introduction

According to the World Health Organization (WHO), mental health is a basic human right and a fundamental component of overall health and well-being (WHO, 2022a, p. xiv; WHO, 2022b, p.1). This perspective reflects WHO broader definition of health, which encompasses not just the absence of disease but the state of complete physical, mental, and social well-being (WHO, 2022a, p. xiv; WHO, 2022b, p.1; WHO, 2021a, p. 2). WHO highlights the significance of mental health by stating:

> "*Good mental health and well-being are essential for all of us to lead fulfilling lives, to realize our full potential, to participate productively in our communities, and to demonstrate resilience in the face of stress and adversity*" (WHO, 2021a, p. v).

However, mental health issues are highly prevalent worldwide, with approximately one in eight people living with a mental disorder, the most common being anxiety and depressive disorders (WHO, 2022a, p. xv). Furthermore, the COVID-19 pandemic has severely challenged global mental health, leading to an increase in mental health conditions with over 25% more cases of anxiety and depression during the first year of the pandemic (WHO, 2022a, p. xiv).This has highlighted the urgent need for targeted interventions to address the exacerbated mental health determinants (Santomauro et al., 2021; WHO, 2022b, p.1; WHO, 2022a, p. xv). In response, WHO has identified mental health as a priority area for accelerated implementation (WHO, 2021a, p. vii).

A particularly vulnerable group at high risk of experiencing mental health problems is university students (Singh & Kumar, 2024; WHO, 2021a, p. 2). Previous studies have confirmed this, showing an elevated prevalence of mental health disorders among university students compared to the general population (Harrer et al., 2019; Medlicott et al., 2021; Ibrahim et al., 2013), especially major depression (Auerbach et al., 2018; Ibrahim et al., 2013) and generalized anxiety disorder (GAD) among other issues (Auerbach et al., 2018). University students face several psychosocial stressors (Farrer et al., 2016), transitional challenges of university life (Hamaideh, 2011), and self-imposed academic stress (Córdova Olivera et al., 2023; Hamaideh, 2011). Additionally, this transitional period often aligns with critical brain development, making students particularly susceptible to mental health disorders (Duffy et al., 2019).

Even in Finland, the happiest country in the world (World Happiness Report, 2021), surveys have shown that one-third of university students suffer from anxiety and

depression, with loneliness exacerbating these conditions (Finnish Institute for Health and Welfare [THL], 2021). The combination of anxiety, depression, and loneliness constitutes significant mental health concerns for university students. It is, therefore, critical for university systems to take proactive measures in promoting mental health and providing support for students (Duffy et al., 2019; THL, 2021) particularly concerning these three variables, which are addressed in this study. Nonetheless, being free from mental problems does not necessarily mean feeling healthy or functioning well (Keyes, 2005). Thus, the promotion of mental health extends beyond simply the absence of illness; to involve nurturing positive mental health (Keyes, 2005; WHO, 2022, p. vi). This entails not only preventing and relieving symptoms of mental health conditions but also enhancing mental well-being (Ng Fat et al., 2017). Consequently, mental well-being is another crucial variable in this study to measure the positive aspects of mental health.

Therefore, the role of the university can be expanded to promote mental health by both alleviating mental health problems and enhancing mental well-being through the implementation of psychological interventions. The concept of intervention generally refers to intentional efforts to create change in individuals or environments, utilizing carefully planned actions (Adelman & Taylor, 1994, pp. 41-42). These interventions can be greatly enhanced by digital technology to be digital interventions, providing more flexibility in scheduling, and reducing travel time and costs (WHO, 2022a, pp. 124-125), making them a promising approach to expand access to psychological support via digital platforms (WHO, 2021a, p. 23). Studies indicated that digital mental health interventions have the potential to significantly enhance mental health in various populations (Klimczak et al., 2023) including university students (Harrer et al., 2019). Thus, integrating digital interventions is a promising avenue for educational institutions to improve mental health at scale (Harrer et al., 2019; WHO, 2022a, pp. 124-125).

Consequently, universities in Finland have been implementing digital interventions for university students to promote their mental health and well-being (Tampere University, 2022). Among these interventions is the digital (internet-based) course "*Towards better well-being and studying*" offered by the *WELLS* research group at the University of Helsinki (Asikainen & Katajavuori, 2021; Katajavuori et al., 2023). This digital intervention course is based on the concepts of *acceptance and commitment therapy (ACT*) aiming to foster students' mental health, well-being, and academic performance (Asikainen & Katajavuori, 2021; Katajavuori et al., 2023).

Acceptance and behavior therapy (ACT) is a psychological intervention based on modern behavioral psychology that targets the development of *psychological flexibility*,

which is defined as the ability to be more consciously connected with the present moment, and to change or commit to behavior(s) that service self-chosen values (Hayes et al., 2006, 2013). Digital ACT interventions, similar to conventional face-to-face ones, have been effective in fostering psychological flexibility (Han & Kim, 2022; Klimczak et al., 2023; Lappalainen et al., 2015, 2021a; Thompson et al., 2021); as well as promoting well-being (e.g. Lappalainen et al., 2021b; Pots et al., 2016) and positive mental health (e.g. Zhao et al., 2022).Notably, while ACT does not focus on symptom reduction (Hayes et al., 2006, 2013), digital ACT interventions, like conventional ones, have shown to effectively alleviate symptoms of anxiety (e.g. Klimczak et al., 2023; Thompson et al., 2021), and depression (e.g. Klimczak et al., 2023; Lappalainen et al., 2015, 2021a,2021b; Pots et al., 2016; Thompson et al., 2021) among other problems.

Furthermore, psychological flexibility, in itself, contributes to decreasing anxiety (e.g. Bluett et al., 2014; Morin et al., 2021) and depression (e.g. Morin et al., 2021; Zhao et al., 2022), as well as enhancing well-being (positive mental health) (e.g. Fledderus et al., 2010, Zhao et al., 2022), indicating that developing this ability contributes to a better mental health (Fledderus et al., 2010).Therefore, digital ACT interventions are effective in alleviating mental health issues, increasing psychological flexibility, and promoting well-being. Similarly, this intervention course, at the University of Helsinki, has been showing similar results of enhancing students' psychological flexibility and well-being (Asikainen & Katajavuori, 2021; Katajavuori et al., 2023).

Nonetheless, there is a need for additional research to evaluate the effectiveness of this course considering both negative (symptoms anxiety and depression, and loneliness) and positive (mental well-being and psychological flexibility) outcomes, to gain a better understanding of the mental health status (Iasiello & Van Agteren, 2020; Trompetter et al., 2017). Furthermore, this study includes the variable of ‘loneliness’; and, to my knowledge, there is a scarcity of research on the effectiveness of digital ACT interventions in addressing loneliness among university students, with previous studies predominantly involving other demographics, such as older adults (Zarling et al., 2023).

This study seeks to evaluate the effectiveness of the University of Helsinki's ‘*Towards Better Well-Being and Studying*’ course, focusing on two main objectives: (1) fostering psychological flexibility, considered the process outcome, and (2) improving mental health, assessing four main indicators—namely mental well-being, anxiety, depression, and loneliness—to offer a comprehensive understanding of the changes in students’ mental health after participating in the intervention course.

2 Theoretical background

This chapter of the theoretical framework addresses the main aspects of the study. Initially, it defines mental health and details its two principal components: well-being (positive mental health) and mental health problems. The discussion begins with well-being, focusing on mental well-being, followed by an examination of mental health problems, specifying the study's three variables: Generalized Anxiety Disorder (GAD), depression, and loneliness. The chapter then shifts to explore mental health among university students, concentrating on the various factors that make this group particularly vulnerable to mental health issues and the prevalence of such problems. Subsequently, the focus turns to Acceptance and Commitment Therapy (ACT). This section explains the historical development of ACT, its philosophical foundations, and theoretical principles. Following that, the next section delves into psychological flexibility and its six core processes. Lastly, the chapter discusses the interplay between ACT, psychological flexibility, and mental health, as demonstrated in previous studies.

2.1 Mental health: Mental well-being and mental health problems

Mental health is defined as the complete state of both the absence of mental health problems and the presence of well-being (positive mental health) (Keyes, 2002, 2005, 2007). This definition aligns with WHO broader understanding of health beyond just the absence of illness (WHO, 2004, p. 12). Building on this perspective Keyes proposed a dual continua model suggesting that mental health consists of both: the absence of mental health problems and the presence of well-being, regarded as distinct yet interrelated continua rather than opposite ends of a single continuum (Keyes, 2005, 2007). The relationship between mental health problems and well-being is debated, with no clear consensus on whether they represent two different continua or two extremes of one continuum (Shah et al., 2021). Nonetheless, a significant body of research supports the two-continua model (e.g., Iasiello & Van Agteren, 2020; Kinderman et al., 2015; Trompetter et al., 2017; Westerhof & Keyes, 2010). Therefore, public mental health initiatives include aspects of both preventing and treating mental illness, as well as promoting mental well-being (Ng Fat et al., 2017).

Well-being is a complex construct (Ryan & Deci, 2001) that is challenging to define (Dodge et al., 2012). In the dual continua model, the continuum of well-being includes both aspects of well-being: *hedonic* and *eudaimonic* (Keyes, 2002, 2005; Keyes & Annas, 2009). *Hedonia* and *eudaimonia* are rooted in Greek philosophy, with the hedonic view focusing on the subjective experience of positive emotions, such as pleasure and happiness, and the absence of negative ones (Ryan & Deci, 2001). On the other hand, the eudaimonic perspective refers to well-being in terms of psychological functioning and living a meaningful life (Ryan & Deci, 2001). The hedonic and eudaimonic perspectives have long been debated, particularly regarding their importance; for instance, Aristotle regarded hedonic happiness as a vulgar aim, reducing humans to mere creatures of desire (Ryan & Deci, 2001). In addition to another argument that the distinction between them is unjustified (Kashdan et al., 2008). However, increasing evidence supports distinguishing between hedonic and eudaimonic well-being (Deci & Ryan, 2008; Kinderman et al., 2015; Ryan & Deci, 2001) to better understand how to promote positive mental health (Keyes & Annas, 2009).

Positive mental health is often used interchangeably with the term *mental well-being* (Tennant et al., 2007). This study uses the term mental well-being, defined as the capacity to cope with everyday stressors and effectively contribute to daily activities (McKay & Andretta, 2017). Mental well-being incorporates hedonic aspects, such as experiencing positive emotions (i.e., feeling good), and eudaimonic aspects related to optimal functioning (i.e., functioning well) in one's life (Clarke et al., 2011; McKay & Andretta, 2017; Ryan & Deci, 2001; Tennant et al., 2007).

The other aspect of mental health addressed in this study is mental health problems, focusing on anxiety, depression, and loneliness. Anxiety is defined as the expectation of an upcoming threat (American Psychiatric Association [APA], 2022a, p.216). It is notable that anxiety disorders are the most prevalent mental disorders worldwide (Javaid et al., 2023; WHO, 2023b), affecting approximately 301 million people in 2019, with higher rates observed in high-income countries (APA, 2022a, p.253; Javaid et al., 2023). One of the most common anxiety disorders, among patients as well as general population, is the Generalized Anxiety Disorder (GAD) (Spitzer et al., 2006); making it a suitable indicator for anxiety symptoms in non-clinical settings such as this intervention university course. GAD is characterized by increased and persistent anxiety while worrying about various life aspects, such as work and school performance, which the person struggles to control (APA, 2022a, p.217). It is also associated with physical symptoms including

restlessness, a sense of being constantly ‘on edge’, muscle tension, fatigue, irritability, concentration difficulties, and disrupted sleep patterns (APA, 2022a, p.217).

The other widespread mental disorder is depression, with symptoms of feeling sadness, emptiness, or irritable mood, with simultaneous alterations that have significant effect on the ability to function (e.g., physical and cognitive changes) (APA, 2022b, p.178). Depression affects 5% of adults (WHO, 2023a), accounting for 4.3% of the global burden of disease (WHO, 2021a, p.3), and ranking as one of the leading causes of disability worldwide (Ibrahim et al., 2013; WHO, 2021a, p.3). Depression is often comorbid with anxiety (Rice et al., 2004; Winer et al., 2017). Even though there is no consensus about the mechanism, several longitudinal studies, across various age groups, showed that anxiety contributes to later depression (Batterham, et al., 2013; Jacobson & Newman, 2014; Rice et al., 2004). Therefore, intervention programs aiming to reduce one of them should also aim to reduce the other (Batterham, et al., 2013).

Another mental health problem that is often associated with anxiety and depression is loneliness (Cacioppo et al., 2006, 2010; Diehl et al., 2018; Heinrich & Gullone, 2006; Jones & Hebb, 2003). Loneliness is defined as the subjective unpleasant feeling of being isolated from others, reflecting a sense of deficiency of desirable social contact (Dagnew & Dagne, 2019; Hays & DiMatteo, 1987). Loneliness is an important, yet often neglected aspect of health for people across all ages (Berlingieri et al., 2023; WHO, n.d.), with prevalence of 10% of the population in western countries (Beckers et al., 2022). Loneliness is a multidimensional phenomenon (Heinrich & Gullone, 2006; Van Tilburg, 2021), often expressed in literature in terms of the three types of *emotional, social*, and *existential* loneliness (Van Tilburg, 2021). *Emotional* loneliness is a result of missing intimacy due to the lack of a spouse or a romantic partner; and *social* loneliness stems from longing for adequate social networks of companions and friends (Russell et al., 1984). Existential loneliness is broader than the earlier two types, as it refers to the painful feelings of separation from the world (i.e., from existence) due to the lack of meaning in life (Van Tilburg, 2021).

People are social creatures (Heinrich & Gullone, 2006; Ousman & Nazir, 2023), therefore, suffering from loneliness has significant detrimental effects on people’s mental health (Berlingieri et al., 2023; WHO, n.d.; Zheng et al., 2023), such as contributing to anxiety, depression, and suicidal behaviors (Heinrich & Gullone, 2006); as well as their physical health (Berlingieri et al., 2023; WHO, n.d.; Zheng et al., 2023) (e.g. cardiovascular problems and poorer immune system) (Heinrich & Gullone, 2006).

Making it an essential public health concern (Beckers et al., 2022; Lim et al., 2020; WHO, n.d.).

However, being alone does not necessarily mean being lonely (Heinrich & Gullone, 2006; Jones & Hebb, 2003).The difference lies in the reaction to feelings of loneliness, as lonely people react with '*sad passivity'*, manifested as crying, doing nothing, overthinking, watching TV, drinking alcohol, and taking tranquilizers (Rubenstein & Shaver, 1982, p.215). On the other hand, nonlonely people react to loneliness with either seeking social contact (e.g. contact/visit a friend), spending money (e.g. shopping), or adopting '*active solitude'* (Rubenstein & Shaver, 1982, p.215). Active solitude (or aloneness) expresses a rewarding use of alone time by: studying, working, practicing a hobby, or a doing a pleasant, and harmless, activity (e.g. going for a walk) (Rubenstein & Shaver, 1982, p.217).

Self-rated loneliness reflects suffering from loneliness; and is related to sad passivity (Van Buskirk & Duke, 1991). On the other hand, active solitude can be a liberating experience with time to flourish and pursue enlightenment far from the crowd (Suedfeld, 1982, p.59, 65). Nonetheless, balance is crucial, because while solitude can be a transcendent experience (Suedfeld, 1982, p.65), healthy social interactions and support are essential to well-being (Axén et al., 2023; Heinrich & Gullone, 2006; Jones & Hebb, 2003*;* Russell et al., 1984; WHO, n.d.), and prolonged loneliness can be detrimental (Ousman & Nazir, 2023). Therefore, interventions to alleviate the negative effects of loneliness are needed (Beckers et al., 2022; Heinrich & Gullone, 2006; Lim et al., 2020).

2.2 Mental health problems among university students

University students exhibit a high prevalence of mental health issues, (Alonso et al., 2018; Auerbach et al., 2018; Beiter et al., 2015; Evans-Lacko & Thornicroft, 2019), including anxiety, depression (Bayram & Bilgel, 2008; Beiter et al., 2015; Eisenberg et al., 2007; Farrer et al., 2016; Li et al., 2022; Rith-Najarian et al., 2019; Shah & Pol, 2020), and loneliness (Dagnew & Dagne, 2019; Diehl et al., 2018; Hysing et al., 2020; McIntyre et al., 2018; Ousman & Nazir, 2023).The transition to a university environment often involves moving away from their established support system of family and friends; this change can emotionally and socially challenge students, putting them at risk of developing symptoms of anxiety and depression (Evans-Lacko & Thornicroft, 2019), which can be exacerbated by feelings of loneliness (Diehl et al., 2018; Hysing et al., 2020; Ousman & Nazir, 2023).

In addition, university students often experience stress related to numerous aspects, such as their overall health, sleep quality (Beiter et al., 2015), self-esteem, body image (Beiter et al., 2015; Farrer et al., 2016) , finances (Beiter et al., 2015; Eisenberg et al., 2007; Farrer et al., 2016), the pressure to achieve academic excellence (Beiter et al., 2015; Córdova Olivera et al., 2023; Evans-Lacko & Thornicroft, 2019; Farrer et al., 2016; Hamaideh, 2011; Ousman & Nazir, 2023; Shah & Pol, 2020) and future employment (Beiter et al., 2015). Moreover, factors such as an unhealthy romantic relationship (Jones & Hebb, 2003; Ousman & Nazir, 2023) or a history of childhood trauma (Ebert et al., 2019) can increase the risk of developing mental health problems. These issues often lead to detrimental effects, including impairment in managing daily activities such as house chores, studies, and relationships (Alonso et al., 2018), as well as academic underachievement (Mojtabai et al., 2015; Ousman & Nazir, 2023).

Consequently, there is a pressing need for higher education institutions to develop strategies and interventions that promote mental health among the vulnerable population of university students (Dagnew & Dagne, 2019; Diehl et al., 2018; Harrer et al., 2019; Hysing et al., 2020; Ibrahim et al., 2013; Ousman & Nazir, 2023; Simegn et al., 2023; Zheng et al., 2023), especially since psychological interventions in educational settings have been showing successful results (Yeager & Walton, 2011). One particularly promising area of intervention, both for the general population and university students, is based on *Acceptance and Commitment Therapy (ACT)* (e.g. Gloster et al., 2020; Levin et al., 2017).

2.3 Acceptance and Commitment Therapy (ACT)

Acceptance and Commitment Therapy (ACT) is a psychological intervention model of behavior change designed to alleviate human suffering and assist individuals in leading rich, fulfilling, value-driven lives (Hayes, 2004; Hayes & Pierson, 2005, p.3; Hayes et al., 2004, p. 4; Hayes et al., 2012, 2013). Utilizing cognitive and behavioral approaches (Hayes, 2004; Hayes et al., 2013), ACT promotes psychological flexibility, encouraging individuals to accept what cannot be changed (Hayes et al., 1999, p. 78), focus on the present moment, and commit to actions aligned with their values (Hayes et al., 2004, p. 4, 13; Hayes et al., 2013). The name "ACT" is pronounced as a single word, not as separate letters (Hayes et al., 1999, p.6), underscoring its emphasis on action-oriented processes; Hayes et al., 2004, p. 13). The subsequent section will explore the historical development of ACT as part of the third wave of cognitive behavior therapy, followed by an explanation of its philosophical and theoretical foundations.

The evolution of *behavior therapy* comprises three significant waves, each reflecting specific theoretical and methodological foundations (Hayes, 2004). The first wave, led by behaviorists (e.g., B.F. Skinner), focused on the observable relationship between environmental stimuli (S) and corresponding responses (R) (Hayes, 2004). Arguing that the main goal of therapy is the mere replacement of symptomatic behavior (e.g., not being able to leave the house) with a healthier/ more adaptable one (e.g. getting outside the house) (Hayes, 2004), through focusing on classical and operant conditioning (Carvalho et al, 2017; Hayes, 2004). The first wave has several drawbacks, such as neglecting internal processes (e.g. thoughts and emotions) (Hayes, 2004).

This led to the development of the second wave, primarily influenced by Aaron Beck and Albert Ellis, which introduced a focus on internal cognitive processes, emotions, and behaviors. This wave argued that maladaptive cognitions lead to undesirable emotions and dysfunctional behaviors, with therapy aimed at rectifying these irrational thoughts (Carvalho et al., 2017; Hayes & Hofmann, 2021; Hayes, 2004). The second wave, occasionally referred to as traditional CBT, was proven helpful for countless individuals worldwide (Hayes & Hofmann, 2021). However, one of its main limitations is not fully addressing contextual factors influencing the behavior (Carvalho et al, 2017; Hayes & Hofmann, 2021).

Consequently, the third wave of cognitive behavioral therapy emerged as an attempt to enhance the effectiveness of the previous two waves by focusing on contextual factors and experiential changes (Carvalho et al, 2017). Emphasizing the need for incorporating philosophical and theoretical foundations into behavioral therapy (Hayes & Hofmann, 2021). This approach is exemplified in ACT, which is underpinned by the philosophy of *Functional contextualism*, and the theoretical foundations of *Rational Frame Theory (RFT)* (Hayes et al., 2004, p. 4; Hayes et al., 2013).

From a philosophical standpoint, ACT subscribes to functional contextualism, which views environmental, behavioral, personal history, and consequential factors as integral to understanding behavior within its context (Hayes et al., 1999, p.18; Hayes & Pierson, 2005, p.1). This worldview focuses on the "interactive whole" rather than isolated actions, asserting that a single action severed from its context is not considered a behavioral event (Hayes et al., 1999, p.18). In functional contextualism, the criterion for truth is the usefulness of a behavior in achieving the individual's goals (Hayes et al., 1999, p. 19). ACT specifically highlights the *functional* role of behavior and its ontological treatment of language (i.e. how language influences our perception and understanding of the world), promoting a comprehensive approach to therapy (Hayes et al., 2012; Hayes & Pierson,

2005, p.1). For instance, unlike traditional CBT, which regards "anxiety" as inherently negative, functional contextualism perceives it as potentially positive or negative, depending on its function in a specific context (Hayes & Hofmann, 2021).

Theoretically, ACT is grounded on Rational Frame Theory (RFT) (Hayes & Pierson, 2005, p.3). RFT is a behavioral theory which encompasses language and cognition (Hayes & Pierson, 2005, p.1). The term “Relational frame” refers to a specific pattern of cognitive relational responses which are controlled by a certain context, and applied arbitrarily (Hayes et al., 1999, p.41; Hayes et al., 2012). Although “relational frame” is a noun, it refers to the person’s action in a specific context (Hayes et al., 1999, p.41). Meaning that the person responds to historically established contextual cues in a way that rationally frames these events together through language (Hayes et al., 1999, p.41). RFT provides insights into the underlying mechanisms and clarifies the processes through which ACT techniques are applied in practice (Hayes & Pierson, 2005, p.1). In ACT, psychopathology is fundamentally associated with various maladaptive functions, collectively termed 'psychological inflexibility' (Hayes et al., 2013). The main goal of ACT is to enhance 'psychological flexibility,' thereby counteracting these maladaptive behaviors and enabling individuals to lead more fulfilling lives (Hayes et al., 2006, 2012). The subsequent text examines 'psychological flexibility' and ‘psychological inflexibility,’ detailing how RFT, as the theoretical foundation of ACT, explains these concepts and their underlying processes.

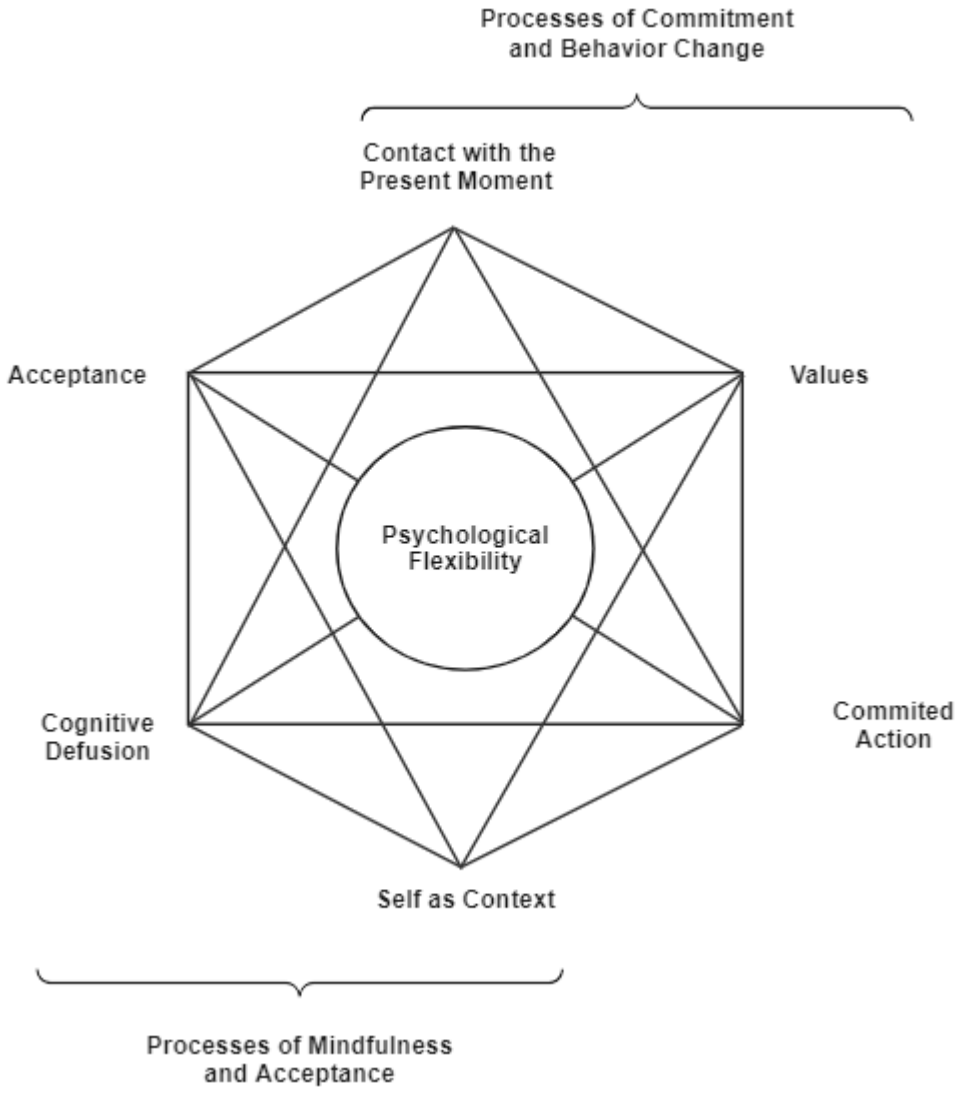
2.4 Psychological flexibility vs. Psychological inflexibility: health processes and psychopathology in ACT

The primary objective of ACT is to enhance psychological flexibility, which allows individuals to live more consciously in the present and persist in behaviors aligned with their self-chosen values (Hayes et al., 2006, 2012). ACT employs acceptance, mindfulness processes, commitment, and behavior change strategies to foster this flexibility (Hayes et al., 2012). In this context, 'psychological flexibility' is a specialized term within ACT, distinct from the broader concept of '*resilience*'—the capacity to adapt and overcome stressful situations successfully (Wu et al., 2013).

Psychological flexibility is cultivated through six sub-processes: *acceptance, cognitive defusion, mindfulness, self as context, values, and committed action* (Hayes et al., 2006, 2012, 2013), as illustrated in Figure 1 (Hayes et al., 2013). These sub-processes

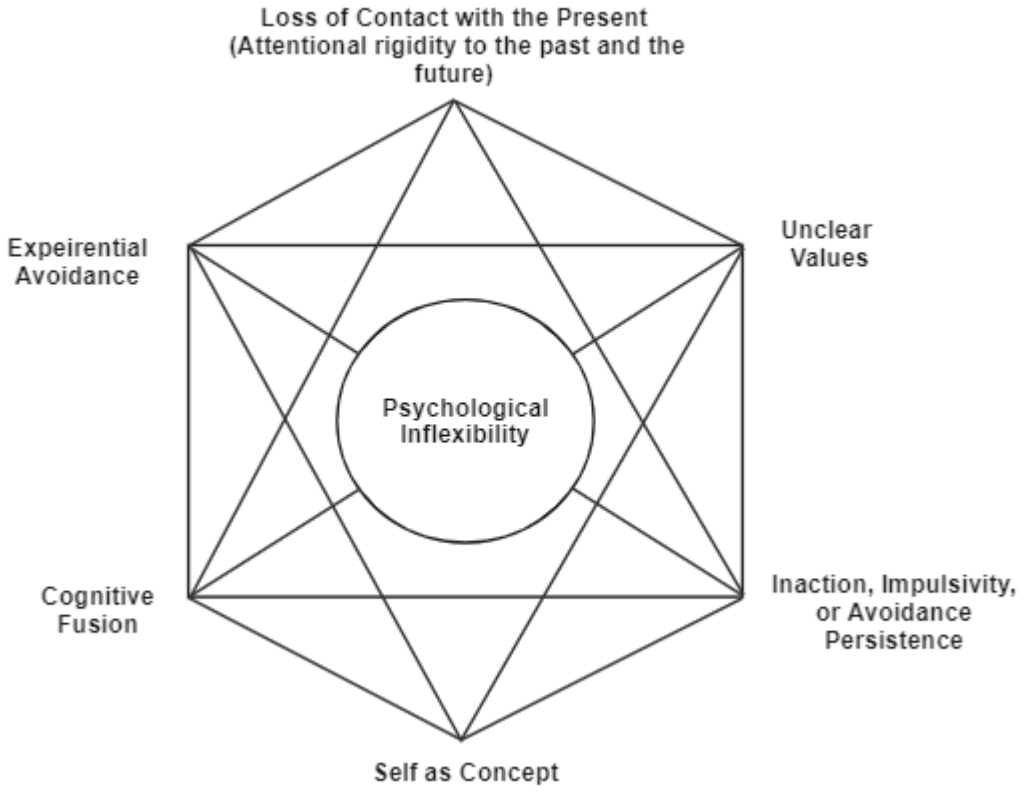
counteract the six maladaptive functions of psychological inflexibility, as depicted in Figure 2 (Hayes et al., 2013). Beyond merely preventing psychopathology, psychological flexibility processes aim to develop positive psychological skills that enrich individuals' lives (Hayes et al., 2006). The following text will detail the six sub-processes of psychological flexibility, explaining how RFT, as the theoretical foundation of ACT, mediates these processes to counteract psychological inflexibility. Additionally, this section will discuss how ACT views language as the primary source of human suffering and how altering one's relationship with language can alleviate this suffering (Hayes et al., 2013; Hayes & Pierson, 2005, p.1).

Figure 1. Hexagon of ACT model of health and treatment, including the six core processes of psychological flexibility



(Hayes et al., 2006, 2013)

Figure 2. Hexagon of ACT model of psychopathology, including the six maladaptive functions of psychological inflexibility



(Hayes at al., 2013)

2.4.1 Cognitive defusion vs. Cognitive fusion

A main maladaptive function within the framework of RFT is *cognitive fusion* (Hayes & Pierson, 2005, p.1), which is the dominance of verbal processes in guiding behavior, excluding other sources of stimulus control (Hayes et al., 2013). In technical terms, "verbal" refers to influence through relational frames. RFT suggests that cognitive fusion results from the extensive use of literal language, and evaluative contexts. While fusion is not inherently harmful, its excessive application can lead individuals to interpret their thoughts literally, overlooking the underlying thought processes.

Psychologically, these cognitive relations are learned behaviors, and a learned behavior, even the pathological one, is never completely unlearned (Hayes et al., 2012). Therefore, ACT does not strive to fight these frames, rather it uses the language itself to loosen them and weaken their effect on the person (Hayes et al., 2012). For example, if a person is having a thought of “I will fail”, ACT does not encourage the person to change

this though or rectify it, instead, it guides the person to perceive this thought as ‘just a thought’, accept its existence, and do the required action regardless (Hayes et al., 2012).

This is a different approach from the traditional (CBT) which urges the individual to challenge or decrease the frequency of a negative thought (Hayes et al., 2012). Meanwhile, RFT, as the theoretical foundation of ACT, argues that it is usually safer to create a more flexible response by weakening the negative impact of a thought rather than defying it (Hayes et al., 2013). Especially that conscious attempts to challenge a negative thought can paradoxically make it even more persistent (Hayes et al., 2013).

Cognitive defusion involves the techniques counteracting cognitive fusion (Hayes et al., 2012, 2013). Therefore, instead of being immersed in negative thoughts (e.g., “I will not succeed”), ACT aims to alter the focus to just mindfully noticing them (Hayes et al., 2012; Hayes et al., 2013). There are several defusion techniques, for example, narrating the thought process (e.g., “*I am having the thought that* I will not succeed”); or giving the thought a shape, color, or form, etc., such as imagining the thought as a passing cloud and watching it as it goes away (Hayes et al., 2012, 2013). These practices make that thought less believable, and consequently decreases its negative impact (Hayes et al., 2006, 2012).

2.4.2 Acceptance vs. Experiential avoidance

Hayes et al. (1996) defined experiential avoidance as a potential pathological process involving a person's unwillingness to engage with specific private experiences (e.g. bodily sensations, emotions, thoughts, memories, and behavioral predispositions). Hence, the individual takes actions to modify the nature or occurrence of these events and the situations that give rise to them.

RFT demonstrates that this avoidance behavior towards some experiences might bring some temporary relief, however, it has long term negative effects (Hayes et al., 2013). According to RFT, an individual uses language to judge, or negatively evaluate an uncomfortable event, categorize it, then avoid it along with any similar or related events. This negative verbal relation associated with the event would lead to exacerbating the negative experience he/she is trying to avoid in the first place (Hayes et al., 2013). For instance, labelling an event (e.g. public speaking) as a ‘shameful experience’ and doing it would cause the person to feel anxious, hence the person avoids it. Paradoxically, this would lead the person to feel anxious anyways, because of thinking

about the idea of public speaking. In other words, the attempt to avoid anxiety-provoking situation paradoxically leads to anxiety itself.

On the other hand, ACT offers *acceptance* as the alternative process to experiential avoidance (Hayes at al., 2006, 2012, 2013). In ACT, acceptance does not mean being passive; rather, it is a process of consciously embracing and being open to life events without trying to avoid them or to change their form or frequency (Hayes at al., 2006, 2012, 2013). These life events can be related to the person's past (e.g., a sad memory), emotions (e.g., anxiety), or even bodily sensations (e.g., physical pain) (Hayes at al., 2006, 2012, 2013). For instance, anxiety patients are told to feel the feelings of anxiety instead of conflicting those feelings (Hayes et al., 2006). In that sense, acceptance is not an end, but a means to enhance the individual's flexibility to personal experiences (Hayes at al., 2006, 2012, 2013). Because acceptance liberates the individual form the resonance of their past (Hayes at al., 2012) and help them become more flexible in their present and future, making acceptance a part of living a values-based life (Hayes at al., 2006, 2012, 2013).

2.4.3 Being present vs. Loss of contact with the present

Loss of contact of with the present refers to a psychopathological pattern of attentional rigidity to the past and the future instead of the present, which intensifies several psychological problems; hence, *being present* (or mindfulness) is the alternative healthy process (Hayes at al., 2012). ACT uses language to promote the individual's focus on the current moment (i.e., in the here and now), by focusing of describing the current event, instead of being fused with the past (e.g., judging) or worried about the future (e.g., predicting) (Hayes at al., 2006, 2012, 2013). Encouraging a sense of self called "self as process" which is the ongoing process of describing thoughts, emotions, sensations and private events without fusion or judgments (Hayes et al., 2006, 2013). To achieve this, ACT uses several techniques, including mindfulness and contemplative exercises (e.g., following the breath) to foster flexible contact with the present moment (Hayes et al., 2012, 2013).

2.4.4 Self as context vs. Self as content

McHugh et al. (2004) explained that Relational Frame Theory (RFT) has emphasized perspective-taking as a form of generalized operant response. According to RFT, proficiency in perspective-taking entails a set of deictic (relational) frames that define a

stimulus relation based on the speaker's perspective. The crucial relational frames for cultivating perspective-taking skills include those of “I and YOU”, “HERE and THERE”, and “NOW and THEN”. According to this perspective, deictic relations develop partly through a history of responding to queries like "What am I doing here?" or "What are you doing now?"; resulting in a generalized relational activity. Consequently, RFT researchers have been interested in creating intervention programs to develop perspective-taking abilities, by directly targeting these relational frames.

Consequently, ACT, as an intervention, uses language to develop perspective-taking abilities leading to a more transcendent sense of self instead of the “conceptualized self” (Hayes et al., 2013). Conceptualized self is how people tend to describe themselves (e.g., “I am a hard worker”, or “I am impulsive”); leading to adherence to these descriptions and refusing any events or contents that contradicts them, resulting in less flexible behaviors (Hayes et al., 2013). Instead, ACT aims to diminish the attachments to these self-narratives and develop a sense of self that is more grounded on the conscious experience of “I, HERE, and NOW” (Hayes et al., 2012); which ACT refers to as “self as context”, “observer perspective”, “transcendent sense of self”, or “noticing self” (Hayes et al., 2013).

For example, if someone said: “I felt sad”, in the conceptualized self, this “I” refers to the content of the experience, leading to more fusion to this experience, known as “self as content” (Hayes et al., 2013). Conversely, ACT proposes that this “I” can reflect the perspective (or locus) of which the person is noticing the experience, producing a more transcendent observing sense of self, which ACT identifies as “self as context” (Hayes et al., 2012, 2013). Self as context holds significance, because it allows individuals to observe their own stream of experiences without becoming attached to them or invested in the specific nature of these experiences, hence fostering defusion and acceptance (Hayes et al., 2006). ACT uses metaphors, mindfulness, and experiential process to practice perspective-taking and developing “self as context” (Hayes et al., 2006, 2013). For instance, an exercise where the individual is asked to imagine their much older self is writing a letter of advice to the current individual who is currently facing hardships, or do a mindfulness activity where they close their eyes, observe a difficult experience, and then observe who is observing (Hayes et al., 2013).

2.4.5 Values vs. Lack of values clarity

Values represent selected qualities of purposeful action that can never be acquired as tangible objects but can be manifested in each passing moment (Hayes et al., 2006). For example, graduating from university is an outcome, but being a passionate learner is a value, manifested in the ongoing process of knowledge-seeking, studying, taking exams going to class and so forth. Even when studies get hard sometimes, it aligns with the individual's values, hence even these hardships become meaningful, showing that, values are not achievable goals (i.e., a destination), rather the direction of which the person follows (i.e. a compass) (Hayes et al., 2013).

ACT strives to help individuals overcome the problem of unclear values by connecting them to their values which are self-chosen, deliberately verbalized, and representing the theme of consistent patterns of activity, consequently reinforcing the behavioral pattern to be intrinsic rather than extrinsic (Hayes et al., 2012, 2013). Only then more flexible decisions can be made, leading to positive outcomes (Hayes et al., 2013). Therefore, ACT undermines the use of language that may lead individuals to have values based on social pressure, avoidance, or fusion (e.g. "I should value X", or "good people value Y") (Hayes et al., 2006, 2013). Besides employing several techniques to help individuals identify and be more conscious about their self-chosen values in various aspects of their lives (e.g., spirituality, family, studies, work) (Hayes et al., 2006, 2013). ACT techniques include metaphors, experiential activities, self-exploration, besides journaling and writing as methods for engaging in values work and tracking the consequences of their values-based actions (Hayes et al., 2012, 2013).

2.4.6 Committed action vs. Inaction/ impulsivity/ avoidance persistence

Committed actions in ACT are the persistent behaviors that align and serve the self-chosen values (Hayes et al., 2012, 2013). While values are not attainable, committed actions are established goals that can be concretely planned and achieved; replacing the psychopathological functions of inaction, impulsivity, or avoidance persistence (Hayes et al., 2013). Having values-driven committed actions is what links the cognitive to the behavioral aspects of ACT, highlighting it as an intervention for behavioral change/therapy (Hayes et al., 2013). These efforts of behavior change are interconnected with other ACT processes, such as acceptance and defusion (Hayes et al., 2006, 2013).

In practice, ACT protocols involve planning behavior change goals (short-, medium-, and long-term) as homework or therapy work (Hayes at al., 2006, 2012, 2013). Examples of the ACT protocol include developing the individual's skills in contingency planning and goal setting (Hayes et al., 2013). The goals are planned and done within the framework of other ACT processes, while being tailored to target specific sets of problems (Hayes et al., 2012). For example, in case of problems related to depression, the emphasis can be on behavioral activation goals; if problem is anxiety, the focus can be on exposure (Hayes et al., 2012, 2013); for quitting smoking, a strategy involving scheduled smoking and gradual reduction might be employed (Hayes et al., 2012).

Although psychological flexibility is often discussed through these six specific sub-processes, Hayes et al. (2011) organized these sub-processes into three dyads, labeled as '*Open, Aware, Active*.' Each dyad represents a common, self-explanatory factor linking the pairs of processes. Specifically, the 'Open' dyad combines 'acceptance' and 'cognitive defusion,' the 'Aware' dyad encompasses 'being present' and 'self as context,' and the 'Active' dyad includes 'values' and 'committed actions' (Hayes et al., 2011). These summarizing terms have proven valuable and relatively straightforward when exploring the potential mechanisms linking psychological flexibility with mental health outcomes (Baker & Berghoff, 2022; Scott et al., 2016). Therefore, the subsequent section employs this categorization along with the six processes to elucidate how psychological flexibility interacts with mental health variables.

In summary, while other therapeutic approaches, such as traditional Cognitive Behavioral Therapy (CBT), may overlook the contextual factors of behavior, the philosophical foundation of Acceptance and Commitment Therapy (ACT), known as functional contextualism, recognizes the utility of a behavior within its broader context, offering a more comprehensive perspective. Additionally, the theoretical underpinnings of Relational Frame Theory (RFT) describe how language influences behavior in specific contexts. Building on these concepts, ACT provides a practical model that demonstrates how particular uses of language can lead to maladaptive behaviors (i.e., processes of psychological inflexibility), whereas alternative uses can foster more adaptive behaviors (i.e., processes of psychological flexibility). This fusion of philosophy, theory, and practical application positions ACT as a holistic approach, suitable not only for addressing problems but also for enhancing the skills needed for a more fulfilling life. Hence, ACT is applicable across a broad range of issues (i.e., it is transdiagnostic) (Dino et al., 2017) and can be adapted for diverse populations and settings (Hayes et al., 2004, pp. 4 & 13; Hayes et al., 2012), thereby qualifying it as an effective educational

intervention for promoting mental health (e.g., Pots et al., 2016) among university students (e.g., Viskovich et al., 2021).

2.5 ACT, psychological flexibility, and mental health

Due to the high prevalence of mental health issues, several studies have underscored the importance of developing digital interventions to promote mental health (Ferreira et al., 2022). This need for accessible psychological support (Hoel et al., 2022) has become especially urgent following the exacerbation of mental health challenges after the COVID-19 pandemic (Klimczak et al., 2023). A systematic review of 48 digital mental health interventions, including CBT, mindfulness-based approaches, and ACT, revealed small-to-medium effects on a wide range of mental health issues among university students (Harrer et al., 2019). Furthermore, a meta-analysis focusing on third-wave digital interventions, including ACT, demonstrated their effectiveness in reducing symptoms of anxiety and depression and improving overall mental health outcomes and quality of life (O'Connor et al., 2018).

Building on this foundation, ACT interventions have consistently achieved positive outcomes in promoting mental health and well-being among diverse populations. Whether delivered face-to-face (e.g., Gloster et al., 2020; Scott et al., 2016) or through digital platforms (e.g., Lappalainen et al., 2021b; Pots et al., 2016), these interventions have shown substantial benefits. Specifically, university students have benefited from both modes of delivery, whether face-to-face (e.g., Grégoire et al., 2018) or digital (e.g., Viskovich et al., 2021). This text explores how ACT interventions, through the mechanisms of psychological flexibility, enhance mental health by fostering well-being and alleviating mental health problems such as anxiety, depression, and loneliness. Particular attention is given to the effectiveness of digital ACT interventions, reflecting the evolving needs and contexts of mental health support.

Research has emphasized the effectiveness of ACT interventions in promoting psychological flexibility (Han & Kim, 2022; Klimczak et al., 2023; Lappalainen et al., 2015, 2021a; Thompson et al., 2021; Zhao et al., 2023). Psychological flexibility, which is the central goal of ACT (Hayes et al., 2012, 2013), is strongly associated with human flourishing (Baker & Berghoff, 2022) and has been linked to significant improvements in mental health and well-being (Bi & Li, 2021; Doorley et al., 2020; Scott et al., 2016; Zhao et al., 2022). Moreover, ACT interventions have proven effective in enhancing well-being, or positive mental health, across various demographic groups (e.g., Gloster et al., 2020;

Lappalainen et al., 2021b; Pots et al., 2016), including university students (e.g., Asikainen et al., 2019; Grégoire et al., 2018; Viskovich et al., 2021).

Although ACT does not primarily aim to reduce symptoms (e.g., Hayes et al., 2013), it has been found effective in alleviating a range of mental health problems. Studies have demonstrated its efficacy in reducing symptoms of anxiety disorders (Bluett et al., 2014; Ferreira et al., 2022; Gloster et al., 2020; Klimczak et al., 2023; Thompson et al., 2021), including generalized anxiety disorder (GAD) (Grégoire et al., 2018; Morin et al., 2021). Additionally, ACT has been effective in mitigating depressive symptoms (Bai et al., 2020; Ferreira et al., 2022; Gloster et al., 2020; Grégoire et al., 2018; Klimczak et al., 2023; Lappalainen et al., 2015, 2021a, 2021b, 2022; Morin et al., 2021; Pots et al., 2016; Thompson et al., 2021; Zhao et al., 2022; Zhao et al., 2023) and feelings of loneliness (Mahmoudpour et al., 2021; Zarling et al., 2023; Ziaee et al., 2022). Furthermore, ACT has proved beneficial in addressing a wide range of issues including substance use, pain, eating disorders, psychosis, somatic complaints (Gloster et al., 2020), rumination (Siyahmansuri & Hashemi, 2023), and hoarding disorder (Ong et al., 2021).

In addition to the effects of ACT interventions, psychological flexibility itself has been significantly associated with reductions in anxiety (Bluett et al., 2014; Morin et al., 2021; Wang et al., 2023), depression (Bluett et al., 2014; Morin et al., 2021; Scott et al., 2016; Trindade et al., 2020; Wang et al., 2023; Zhao et al., 2022), and loneliness (Frinking et al., 2020; Ortega-Jiménez et al., 2021). Several studies have examined how the six subprocesses of psychological flexibility influence mental health outcomes. For simplicity, these subprocesses are grouped into three dyads under the 'Open, Aware, Active' categorization (Baker & Berghoff, 2022; Hayes et al., 2011).

The first dyad, 'Open', includes the processes of 'cognitive defusion' and 'acceptance' (Hayes et al., 2011). Starting with 'cognitive defusion,' research has shown its utility in addressing anxiety (Baker & Berghoff, 2022; Bardeen & Fergus, 2016; Batten, 2011, p.83; Cookson et al., 2020), depression (Baker & Berghoff, 2022; Bardeen & Fergus, 2016; Batten, 2011, p.88; Cookson et al., 2020; Scott et al., 2016; Zhao et al., 2022), loneliness (Castro et al., 2021), stress (Baker & Berghoff, 2022; Bardeen & Fergus, 2016), and posttraumatic stress (Bardeen & Fergus, 2016). It also promotes quality of life (Baker & Berghoff, 2022), social functioning, and both mental (Scott et al., 2016), and physical health (Bodenlos et al., 2020), highlighting the profound impact of thought processes on overall well-being.

Next, within the 'Open' dyad, 'acceptance' counters the psychopathological process of 'experiential avoidance' (Hayes et al., 2011, 2013). Experiential avoidance is linked to an increase in the severity of worry and anxiety, connecting several risk factors such as 'intolerance to uncertainty' with pathological worrying (Akbari & Khanipour, 2018). It also maintains symptoms of anxiety (Baker & Berghoff, 2022; Batten, 2011, p.76; Roemer et al., 2008), depression (Bardeen & Fergus, 2016; Batten, 2011, p.86; Cookson et al., 2020), stress, and posttraumatic stress (Bardeen & Fergus, 2016). Notably, experiential avoidance mediates the relationship between loneliness and stress perception – the greater the experiential avoidance, the more significant the impact of loneliness on stress (Ortega-Jiménez et al., 2021).

'Acceptance' has proven helpful in alleviating symptoms of anxiety (Bardeen & Fergus, 2016; Cookson et al., 2020) and depression (A-Tjak et al., 2021; Almarzooqi et al., 2017; Bardeen & Fergus, 2016; Cookson et al., 2020; Scott et al., 2016). It is also positively correlated with social functioning and mental health (Scott et al., 2016). This underscores the importance of the openness processes (i.e., 'cognitive defusion' and 'acceptance') in embracing diverse experiences and mitigating the influence of negative thoughts, thereby alleviating undesirable emotional states.

As for the ‘Aware’ dyad—which entails the processes of ‘being present’ and ‘self as context’—‘being present’ has been found to alleviate depression (Batten, 2011, p.88) and anxiety (Roemer et al., 2008), and to mediate changes in stress, depression, and well-being (Räsänen et al., 2020). Meanwhile, ‘self as context’ (or decentering) is negatively correlated with anxiety (Baker & Berghoff, 2022) and depression (A-Tjak et al., 2021; Scott et al., 2016), and is associated with greater quality of life, social functioning, and mental health (Scott et al., 2016), thus underscoring how these processes of increased awareness—living in the present moment (HERE and NOW) and adopting a transcendent perspective—positively contribute to mental health.

Similarly, the third dyad ‘Active’—comprising the processes of ‘values’ and ‘committed actions’—is linked to better mental health. Valued living correlates significantly with mental health, social functioning, vitality, and performance despite emotional or physical challenges (Wilson et al., 2010). It is also negatively associated with mental health issues like anxiety, depression, hostile attitudes, and relationship difficulties (Wilson et al., 2010). Furthermore, a meaning-oriented approach reduces psychological distress (Räsänen et al., 2020). A study on value clarification among university students revealed that such clarification shifts actions towards being intrinsically motivated and task-related, rather than extrinsically motivated and

performance-related (Viskovich et al., 2021). This shift offers numerous benefits, including reducing psychological distress and enhancing academic performance, well-being, and overall mental health (Viskovich et al., 2021). Additionally, 'committed action', which translates self-chosen values into desirable behavioral changes, shows negative correlations with anxiety, stress (Baker & Berghoff, 2022; Batten, 2011, p.83), and depression (Baker & Berghoff, 2022; Scott et al., 2016), and positive correlations with quality of life (Baker & Berghoff, 2022; Wilson et al., 2010 social functioning and well-being (Scott et al., 2016).

While several studies have explored the relationship between the six subprocesses of psychological flexibility and mental health outcomes, this area of research is relatively recent (Baker & Berghoff, 2022; Zhao et al., 2022), and future studies are expected to provide further insights into these dynamics.

Cumulatively, prior research reveals that (digital) ACT interventions and psychological flexibility, including its six processes, promote mental health and well-being, proving beneficial for diverse populations, including university students at risk. Consequently, the digital ACT-based intervention course "*Towards better well-being and studying*" was introduced at the University of Helsinki to boost students' well-being and study skills (Asikainen & Katajavuori, 2021). This course has proven effective in enhancing students' psychological flexibility (Asikainen et al., 2024; Katajavuori et al., 2023; Räihä et al., 2024), well-being (Katajavuori et al., 2023) and studying skills (Räihä et al., 2024), and in improving time and effort management (Asikainen et al., 2024), while reducing procrastination (Asikainen et al., 2024) and study-related burnout (Räihä et al., 2024). Nonetheless, more research is needed to examine the impacts of this course on students' mental health using both positive (i.e., mental well-being) and negative (i.e., anxiety, depression, and loneliness) measures to gain a comprehensive understanding of students' mental health status and to confirm these results on psychological flexibility. Moreover, given the limited research on the effects of (digital) ACT interventions on loneliness among university students, further studies are needed. Hence, this study aims to address these gaps by assessing the impacts of this digital ACT intervention course on university students' psychological flexibility and mental health in terms of mental well-being, anxiety, depression, and loneliness.

3 Research task and research questions

3.1. Research task

The aim of this study is to examine the changes in university students' psychological flexibility and mental health upon completing the digital ACT-based intervention course "*Towards better well-being and studying*". In this research, mental health is operationalized positively in terms of mental well-being, and negatively in terms of symptoms of anxiety, symptoms of depression, and loneliness.

Based on the research task, the research questions are:

3.2.1 What changes have occurred in students' psychological flexibility after the intervention course?

3.2.2 What kind of changes have occurred in students' mental health, in terms of mental well-being, symptoms of anxiety, symptoms of depression, and loneliness, upon completing the intervention course?

4 Methods

4.1 The main research project

In response to declining mental health among university students in Finland (THL, 2021), the WELLS research project at the University of Helsinki developed a digital ACT-based intervention course titled "*Towards Better Well-being and Studying*". This course aims to enhance university students' well-being by improving their psychological flexibility (Asikainen & Katajavuori, 2021). It has been offered as an optional course to students across all faculties since the academic year 2020-2021. The effectiveness of this course has been evaluated using a longitudinal experimental design, primarily involving questionnaires and reflective journals. This study, part of the WELLS research group studies, focuses on assessing the course's impact on students' psychological flexibility and mental health, utilizing data gathered during the autumn semester of 2022.

4.2 Design of the digital ACT intervention course

The ACT-based intervention course is delivered via the digital *Moodle* platform over eight weeks. It is offered as an optional 3-credit course for university students at bachelor's, master's, and doctorate levels (Asikainen & Katajavuori, 2021). The course consists of eight modules, each designed to foster psychological flexibility by focusing on a specific theme. From 'Week 2' to 'Week 7', each module addresses one or two aspects of psychological flexibility, as shown in Table 1 (Asikainen & Katajavuori, 2021). Each module begins with an introductory video and a textual overview of the week's theme (Asikainen & Katajavuori, 2021). Throughout the course, students engage with the week's theme through independent assignments and reflect on the content in small groups, exchanging peer feedback on their work (Asikainen & Katajavuori, 2021). These reflection exercises and peer interactions serve as pedagogical strategies to support learning (Asikainen & Katajavuori, 2021). The instructor's role is to monitor and facilitate student progress, meet with students online, and provide weekly video instructions about each module and its assignments (Asikainen & Katajavuori, 2021).

Table 1.The design of the digital ACT-based intervention course: "*Towards better well-being and studying."*

Week	Theme of the module	Psychological Flexibility subprocess(es)	Assignments	Measurements
1	Introduction		Start of the peer group work	Pre-intervention measurement
2	What is important?	'Values'	-Individual assignments; and -Group discussion and reflection.	Reflective journal
3	Focusing on the present	'Being present' and 'Acceptance'		
4	Power of thoughts	'Cognitive diffusion' and 'Self as context'		
5	Coping with studying	'Committed action'		
6	Acceptance and self-compassion	'Acceptance' and 'Self as context'		
7	Value-based action	'Committed action'		Post-intervention measurement
8	Conclusion		-Individual feedback to two peers about the reflective journal. -Group discussion	

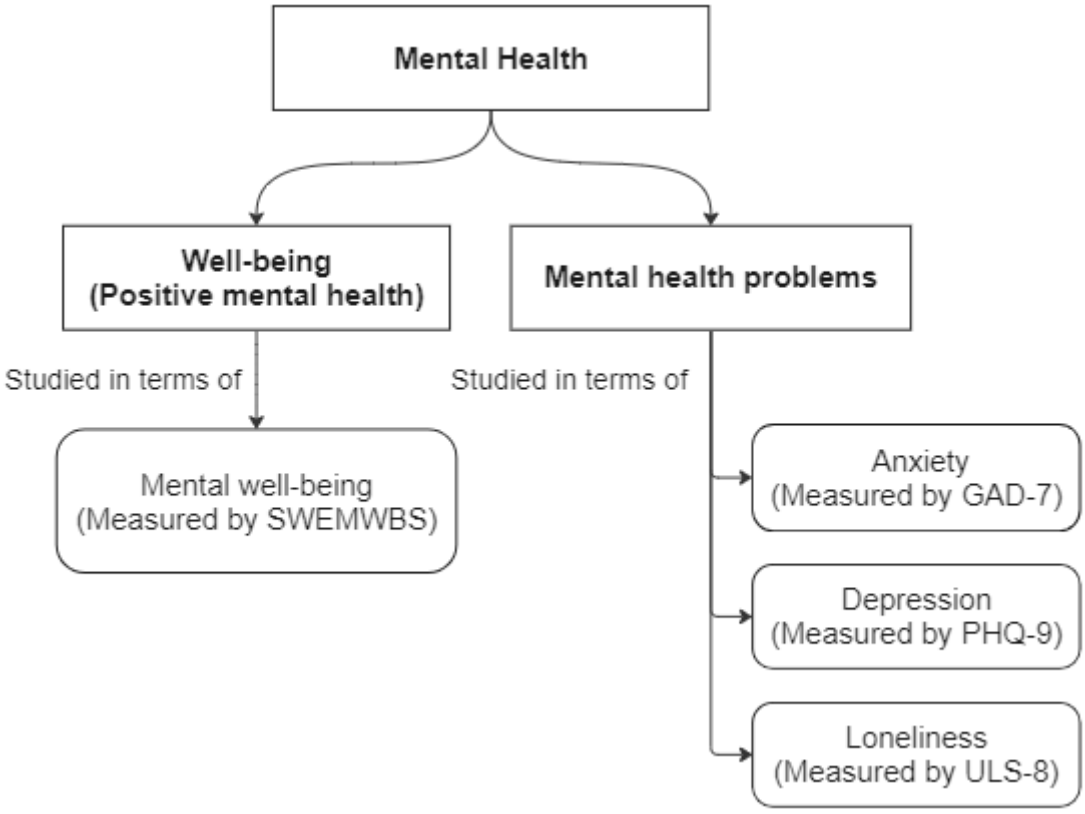
(Asikainen & Katajavuori, 2021)

4.3 The present study design and participants

This study aims to investigate the changes that have occurred in university students' psychological flexibility and mental health upon completing the intervention course at the University of Helsinki. Participants (n=116) were Finnish university students who willingly enrolled in the intervention course during the autumn semester of 2022. The final dataset included responses from 98 participants who completed the intervention course and all pre-and post-intervention scales. This group consisted of 83 females (84.7%), 13 males (13.3%), one non-binary individual (approximately 1%), and one participant who did not specify their gender (approximately 1%). Their ages ranged from 21 to 52, with a mean (M) age of 28.7 and a standard deviation (SD) of 7. These students represented 11 different faculties and varied educational levels, predominantly bachelor's students (78.6%), followed by master's students (20.7%), and one PhD student (approximately 1%). Additional participant characteristics, such as marital status and household situation, are detailed in **Appendix 1.**

Participants completed several questionnaires on the Moodle platform, about psychological flexibility and mental health, both pre- and post-intervention. To gain a comprehensive understanding of the participants' mental health in this study, both aspects of mental health are addressed: well-being, in terms of mental well-being, and mental health problems in terms of anxiety, depression, and loneliness, as illustrated in Figure 3. To answer the research questions, the changes in students' psychological flexibility and mental health were quantitatively analyzed by comparing the pre- and post-intervention responses using repeated measures t-test (Ross & Willson, 2017, p.17), via IBM SPSS Statistics (version 28).

Figure 3. Mental health outcome variables and their measures in this study



Note. SWEMWBS= Short Warwick Edinburgh Mental Well-Being Scale.GAD-7= Generalized Anxiety Disorder 7-item scale; PHQ-9= Patient Health Questionnaire (Depression module); ULS-8= Short-form UCLA Loneliness scale.

4.4 Measures

In this study, quantitative measures comprise five distinct tools: one to assess psychological flexibility as a process outcome and four to gauge indicators of mental health as the primary outcomes. These four measures operationalize mental health positively in terms of mental well-being, and negatively in terms of symptoms of anxiety, symptoms of depression, and loneliness.

4.4.1 Measuring Psychological flexibility

This study measured psychological flexibility using the Work-Related Acceptance and Action Questionnaire (WAAQ; Bond et al., 2013), which Asikainen et al. (2018) adapted to assess psychological flexibility within the context of university studies. The WAAQ consists of seven items, such as *'I can study effectively even if I have worries*' and *'I can do what is required of me in my studies, despite any emotions I may be having.*' Responses are rated on a scale from 1 (Strongly disagree) to 5 (Strongly agree) (Asikainen et al., 2018), with higher scores indicating greater levels of psychological flexibility (Asikainen et al., 2018; Bond et al., 2013). The WAAQ has demonstrated good psychometric properties, including sound structure, reliability, and validity (Bond et al., 2013). Additionally, it has proven effective in measuring psychological flexibility in both work-related contexts among professionals (e.g., Holmberg et al., 2019) and among university students (e.g., Katajavuori et al., 2023; Ponce & Villar, 2022; Räihä et al., 2024).

4.4.2 Measuring mental health

Mental well-being: The Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS)

This study assessed mental well-being using the Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS; McKay & Andretta, 2017; Stewart-Brown et al., 2009). The SWEMWBS comprises seven positively worded statements designed to measure mental well-being, covering both hedonic and eudaimonic aspects. Each statement is rated on a 5-point Likert scale ranging from 0 (None of the time) to 4 (All of the time) (Stewart-Brown et al., 2009). SWEMWBS is a concise version of the original 14-item Warwick-Edinburgh Mental Well-being Scale (WEMWBS; Stewart-Brown et al., 2009), created to reduce respondent burden (Ng Fat et al., 2017).

Initially, it was believed that the SWEMWBS predominantly represented eudaimonic rather than hedonic well-being (Ng Fat et al., 2017; Stewart-Brown et al., 2009). However, a recent psychometric study with a large sample size revealed that the items of SWEMWBS capture both hedonic (e.g., item 1: *'I have been feeling optimistic about the future*') and eudaimonic well-being (e.g., item 7: '*I have been able to make up my own mind about things*') (Sarasjärvi et al., 2023). The SWEMWBS has demonstrated strong construct validity and inter-item consistency (McKay & Andretta, 2017; Shah et al., 2021; Stewart-Brown et al., 2009). It has been proven effective in evaluating mental well-being across diverse populations (e.g., Koushede et al., 2019; Sarasjärvi et al., 2023). Moreover, its responsiveness to change makes it a valuable tool in both evaluation and intervention studies (Koushede et al., 2019; Ng Fat et al., 2017; Shah et al., 2021).

Symptoms of anxiety: The brief measure for assessing Generalized Anxiety Disorder (GAD-7)

The Generalized Anxiety Disorder 7-item scale (GAD-7; Spitzer et al., 2006) is a self-report questionnaire designed to screen for generalized anxiety disorder (GAD) and to assess the severity of its symptoms in both research and clinical settings (Spitzer et al., 2006). The GAD-7 is based on the symptom criteria for GAD outlined in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). It includes items such as *'Feeling nervous, anxious or on edge'* and *'Trouble relaxing*.' Each item is rated on a 4-point Likert scale, from 0 (Not at all) to 3 (Nearly every day) (Spitzer et al., 2006). The GAD-7 demonstrates strong inter-item consistency, validity, and overall psychometric properties, making it an effective tool for the universal screening of GAD across diverse populations, including university students (e.g., Byrd-Bredbenner et al., 2020; Grégoire et al., 2018).

Symptoms of Depression: The Patient Health Questionnaire (PHQ-9)

Symptoms of depression were measured using the Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001). The PHQ-9 is the depression module from the full Primary Care Evaluation of Mental Disorders Patient Health Questionnaire (PRIME-MD PHQ) (Kroenke et al., 2001). This module comprises nine items that assess the severity of depression symptoms based on the DSM-IV diagnostic criteria (Kroenke et al., 2001). Example items include *'Thoughts that you would be better off dead or of hurting yourself in some way'* and *'Feeling tired or having little energy'* (Kroenke et al., 2001). Each item is rated on a 4-point Likert scale, from 0 (Not at all) to 3 (Nearly every day). The total

score, which ranges from 0 to 27, reflects the severity of depression (i.e., 5= mild, 10= moderate, 15= moderately severe, 20= severe depression) (Kroenke et al., 2001). The PHQ-9 has demonstrated strong psychometric properties (Keum et al., 2018; Kroenke et al., 2001) and is sensitive to changes over time (Kroenke et al., 2001), making it a suitable measure for intervention studies. Consequently, the PHQ-9 has been employed in various research contexts, including ACT intervention studies (e.g., Grégoire et al., 2018; Lappalainen et al., 2021a), and among diverse populations such as university students (e.g., Keum et al., 2018).

Loneliness: The short version of the revised UCLA loneliness scale (ULS-8)

The short version of the Revised University of California Los Angeles Loneliness Scale (ULS-8) is a self-administered measure of loneliness (Hays & DiMatteo, 1987). The ULS-8 consists of eight items, including *'I feel isolated from others'* and *'I lack companionship*', with responses for each item ranging from 1 (Never) to 4 (Often) (Hays & DiMatteo, 1987). Notably, items number 3 and 6 are reverse-scored (e.g., item 6: *'I can find companionship when I want it'*), making the reversal of these items' scores crucial when calculating the final score. ULS-8 was developed through an exploratory factor analysis of the original 20-item Revised UCLA Loneliness Scale (ULS-20; Hays & DiMatteo, 1987; Russell, 1996; Russell et al., 1980). The ULS-8 offers a more practical alternative due to its shorter length and reduced respondent burden; it also maintains validity and reliability (Hays & DiMatteo, 1987). The ULS-8 has been employed in numerous studies to measure loneliness among university students across various countries (e.g., Wu & Yao, 2008) and has proven effective even when translated into different languages (e.g., Doğan et al., 2011; Swami, 2009).

4.5 Statistical analyses

This study used quantitative method to evaluate the effectiveness of the intervention course on the participants' psychological flexibility and mental health, by comparing their responses to the measures before and after the intervention course using IBM SPSS statistics (version 28). Quantitative analysis was found suitable as it gives insights about the levels of changes in the outcome variables using standardized scales, providing a picture about the possible effects of the course on students' psychological flexibility and mental health.

Normality of all the outcome variables was established graphically (Anscombe,1973; Tabachnick & Fidell, 2014, p.79) by visually examining the histograms, Q-Q plots and box plots of all outcome variables. Hence, analysis proceeded using parametric statistical analyses, starting with reliability testing for all the scales, followed by the repeated measures t-test to answer the research questions (More details are explained in the following text).

Reliability of all the measurements in terms of internal consistency was confirmed using Cronbach's alpha (α) (Cronbach, 1951); all the scales had Cronbach's alpha values ranging from 0.7 to less than 0.9, indicating that all scales have good reliability (Tavakol & Dennick, 2011) (See Table 2 for Cronbach's alpha values of all the scales pre- and post the intervention)**.** As mentioned earlier, ULS-8 scale has two reverse items (items 3 and 6), therefore, the responses to them were programmed to have their values reversed when extracting the data. To confirm that the scores of the reverse items (items 3 & 6) were reversed before performing the analysis, Cronbach's alpha had an additional benefit, as high values reflected good inter-item consistency (ULS-8: Pre-intervention (α)= .841, Pre-intervention (α)= .881); confirming that the scores of the reverse items were indeed reversed, and that the scale results are ready for analysis.

Table 2. Reliability test results using Cronbach's alpha (α) for all outcome measures pre- and post- intervention course

Outcome measures	N	Pre-intervention (α)	Post-intervention (α)
Psychological Flexibility (WAAQ)	98	.893	.877
Mental Health Indicators			
Mental well-being (SWEMWBS)	98	.774	.807
Anxiety (GAD-7)	98	.823	.847
Depression (PHQ-9)	98	.799	.803
Loneliness (ULS-8)	96	.841	.881

Note. N= number of participants; α = Cronbach's alpha; WAAQ= The Work-related Acceptance and Action Questionnaire; SWEMWBS= Short Warwick Edinburgh Mental Well-Being Scale; GAD-7= Generalized Anxiety Disorder 7-item scale; PHQ-9= Patient Health Questionnaire (Depression module); ULS-8= Short-form UCLA Loneliness scale.

To answer the research questions, changes in students' psychological flexibility and mental health indicators during the intervention course were assessed by comparing pre- and post-intervention scores for each variable using *repeated measures t-test***,** which is the t-test used when comparing the means of the same group on the same

measurements at two time points (Ross & Willson, 2017, p.17). Then, results were estimated according to the *P* value and *Effect size* (ES). *P* value indicates statistical significance, usually, if it is smaller than the cut-off point of .05, revealing whether an effect exists (Sullivan & Feinn, 2012); while effect size (ES) represents the magnitude of this effect (Sullivan & Feinn, 2012). Therefore, it is vital in this quantitative intervention study to report both the *P* value and effect size (ES) to understand the effect of the intervention course (Sullivan & Feinn, 2012). One of the most frequently used indicis to estimate effect size is *Cohen's d* (Sullivan & Feinn, 2012). Cohen's d (*d*) was used in this study to indicate the effect size following Cohen's (1988, pp. 25-26) rule of thumb that effect sizes are classified as small, medium, and large, when Cohen's d values are (*d*=0.2), (*d*=0.5) and (*d*≥0.8) respectively.

4.6 Ethical considerations

Ethical guidelines were rigorously followed in this study. The University of Helsinki approved the research protocol (see the research protocol by Asikainen & Katajavuori, 2021). Participants provided informed consent for the use of their data in research, and all data were anonymized prior to analysis. This project, including the current study, adheres strictly to the ethical guidelines set forth by the Finnish National Board on Research Integrity (TENK) (Finnish national board on research integrity [TENK], 2023).

5 Research results and their interpretation

Students' responses to outcome variables were measured pre- and post- the intervention course, and the changes of the means of the outcome variables overtime were estimated as shown in Table 3 and Figure 4, reflecting that there was an increase in the levels of psychological flexibility and mental well-being, and a decrease in anxiety, depression, and loneliness.

Table 3. Mean changes between pre- and post- intervention

Outcome measures	N	Pre-intervention Mean (SD)	Post-intervention Mean (SD)
Psychological Flexibility (WAAQ)	98	21.12 (6.49)	27.89 (7.90)
Mental Health Indicators			
Mental well-being (SWEMWBS)	98	24.38 (3.35)	25.13 (3.54)
Anxiety (GAD-7)	98	7.06 (4.08)	5.85 (3.99)
Depression (PHQ-9)	98	5.65 (4.23)	5.34 (4.19)
Loneliness (ULS-8)	96	16.88 (4.71)	15.95 (4.97)

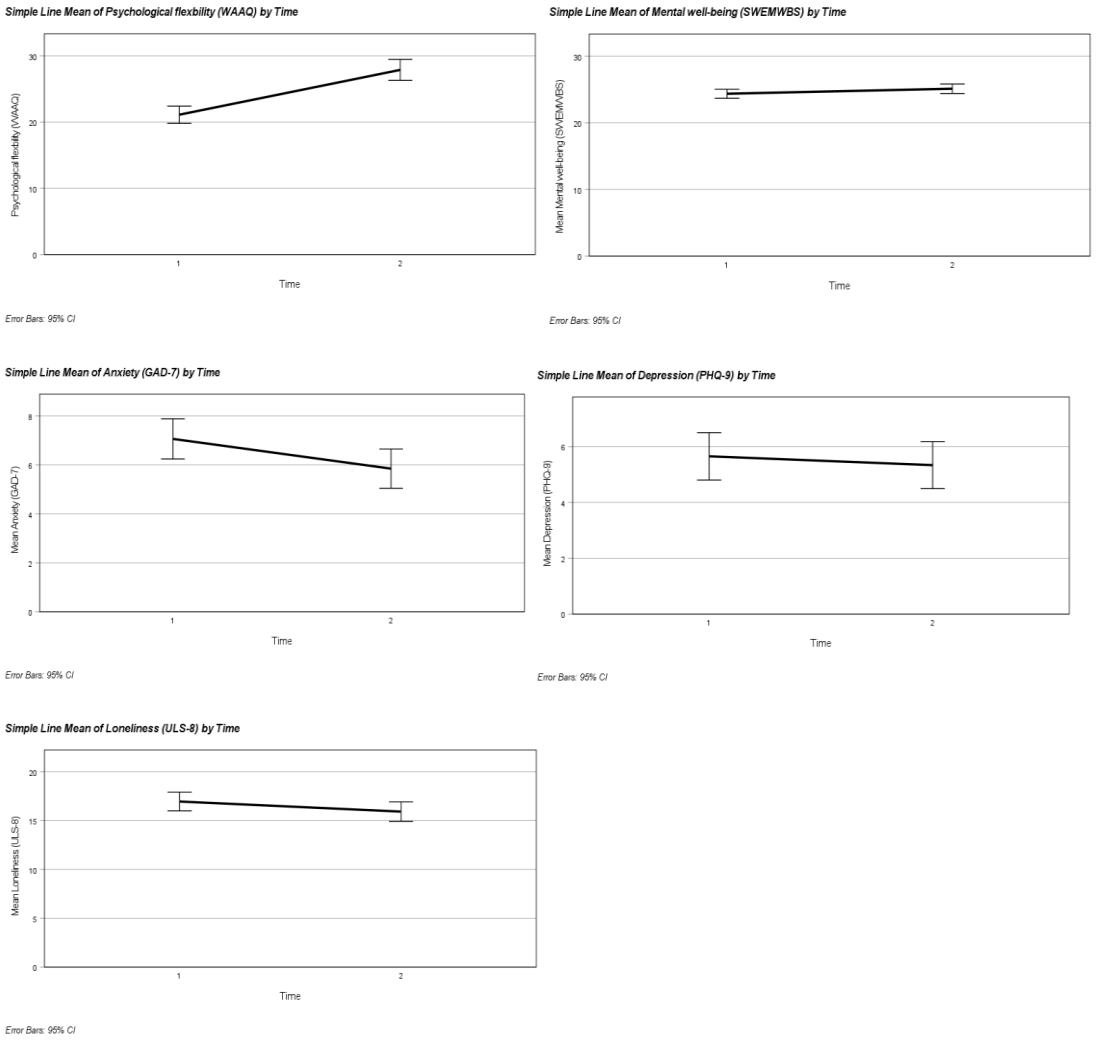
Note. N= number of participants; SD = Standard deviation; WAAQ= The Work-related Acceptance and Action Questionnaire; SWEMWBS= Short Warwick Edinburgh Mental Well-Being Scale; GAD-7= Generalized Anxiety Disorder 7-item scale; PHQ-9= Patient Health Questionnaire (Depression module); ULS-8= Short-form UCLA Loneliness scale.

The results of repeated measures t-test as shown in Table 4 indicate that the differences between pre- and post-intervention was statistically significant for psychological flexibility ($t(97)= 11.825$, $p <.001$, $d= 1.194$, 95% CI [0.933, 1.452]) , mental well-being ($t(97)= 2.374$, $p = .02$, $d= 0.24$, 95% CI [0.038 – 0.44]), anxiety ($t(97)= -3.364$, $p =.001$, $d= -0.34$, 95% CI [-0.543, -0.135]), and loneliness ($t(95)= -3.236$, $p =.002$, $d= -0.33$, 95% CI [-0.535, -0.124]). However, the difference between the two measure points was not statistically significant for depression ($t(97)= -0.924$, $p = .358$, $d=-0.093$, 95% CI [-0.292, 0.105]).

Effect sizes show that the intervention course contributed to an increase in psychological flexibility with large effect size ($d= 1.194$); and an increase in mental well-being with small effect size ($d= 0.24$). In addition, upon finishing the intervention course, there was a decrease in anxiety levels with small effect size ($d= -0.34$), as well as a decline in loneliness with small effect size ($d= -0.33$). Depression levels were initially low (M= 5.65, SD= 4.23), and it slightly decreased even more after the intervention course

(M= 5.34, SD= 4.19); however, t-test reveals that this decrease was not statistically significant (p = .358).

Figure 4. Outcome measures mean change over time from pre- to post- the intervention course



In summary, upon undergoing the intervention course, there was a significant increase in the students' psychological flexibility with large effect size. As for mental health indicators, students' mental well-being levels were significantly elevated with small effect size, while levels of anxiety and loneliness significantly decreased with a small effect size for both. Depression levels decreased after the intervention course; however, the decrease was not statistically significant.

Table 4. Results of repeated measures t-test (paired-samples t-test) comparing outcome measures between pre- and post-intervention.

Outcome measures	df	t-statistics	*p*	d	95% C.I.	Effect size
Psychological Flexibility (WAAQ)	97	11.825	**<.001***	1.194	0.933 – 1.452	Large
Mental Health Indicators						
Mental well-being (SWEMWBS)	97	2.374	**.020***	0.240	0.038 – 0.44	Small
Anxiety (GAD-7)	97	-3.364	**.001***	-0.340	-0.543 – -0.135	Small
Depression (PHQ-9)	97	-0.924	.358	-0.093	-0.292 – 0.105	Non-significant
Loneliness (ULS-8)	95	-3.236	**.002***	-0.330	-0.535 – -0.124	Small

Note. *p < 0.05; values in bold are statistically significant; *p*= p-value; df= degree of freedom; d= Cohen's d; 95% C.I.= 95% Confidence Interval; WAAQ= The Work-related Acceptance and Action Questionnaire; SWEMWBS= Short Warwick Edinburgh Mental Well-Being Scale; GAD-7= Generalized Anxiety Disorder 7-item scale; PHQ-9= Patient Health Questionnaire (Depression module); ULS-8= Short-form UCLA Loneliness scale.

6 Discussion

The aim of this study was to explore how students' psychological flexibility and mental health indicators—anxiety, depression and loneliness— have changed during the digital ACT-based intervention course "*Towards Better Well-being and Studying*". The results suggested that the intervention course enhanced students' psychological flexibility and promoted their mental health by increasing their mental well-being and decreasing their anxiety and loneliness, while having no significant effect on their levels of depression.

The first research question of this study asked: What changes have occurred in students' psychological flexibility after the intervention course? The results indicated a significant increase in psychological flexibility levels after the course. This finding is consistent with the theoretical framework of ACT (Hayes et al., 2012, 2013) and aligns with previous research on the same intervention with university students (Katajavuori et al., 2023; Räihä et al., 2024), as well as other digital ACT interventions for various populations (e.g., Han & Kim, 2022; Klimczak et al., 2023; Lappalainen et al., 2015, 2021a; Thompson et al., 2021). These findings reflect the efficiency of this digital ACT-based intervention course in increasing psychological flexibility—a skill that can be improved with appropriate training (Hayes et al., 1999, 2006).

The second research question investigated the changes in students' mental health during the intervention course, specifically examining mental well-being, symptoms of anxiety, depression, and loneliness. The results of the repeated measures t-test indicated a significant increase in students' mental well-being, and a significant decrease in anxiety and loneliness levels, but not depression.

The enhancement of students' mental well-being upon completing the course aligns with findings from another study on the same course (Katajavuori et al., 2023), although that study used different measures. The improvement in mental well-being observed after the course could be interpreted as related to the contribution of psychological flexibility. As measured in this study, mental well-being comprises both hedonic well-being, which pertains to positive feelings, and eudaimonic well-being, which reflects living a fulfilling meaningful life (Deci & Ryan, 2008; Ryan & Deci, 2001). Building on this understanding, the various processes of psychological flexibility likely contributed to its enhancement as follows: Within the 'Open' dyad, the process of 'cognitive defusion' is intended to foster disengagement from negative thoughts, while 'acceptance' helps promoting openness to positive experiences (Hayes et al., 2011). Additionally, in the

'Aware' dyad, the process of 'being present' has been shown to reduce stress and increase well-being (Räsänen et al., 2020). Therefore, these processes—cognitive defusion, acceptance, and being present—likely contributed to enhancing hedonic well-being. Moreover, the 'Active' dyad likely helped students lead more meaningful lives through its processes of 'clarified values' and 'value-based actions', thus promoting eudaimonic well-being. Suggesting that fostering psychological flexibility could play a crucial role in holistically nurturing both aspects of mental well-being.

The findings regarding the decrease in anxiety levels following the intervention align with previous systematic reviews and meta-analyses, which suggest that digital ACT interventions contribute to reduced anxiety levels (Klimczak et al., 2023; Thompson et al., 2021). Although ACT does not primarily focus on symptom reduction (e.g., Hayes et al., 2012, 2013), these results, similar to other studies (Wang et al., 2023), can be interpreted as indicating that fostering psychological flexibility aids in reducing anxiety symptoms.

Anxiety is associated with cognitive fusion with baseless fears and concerns about the future, as well as experiential avoidance to evade facing these fears (Batten, 2011, pp.75-76). Thus, the results of this study can be interpreted by considering the possible contribution of fostering the six subprocesses within the three dyads of psychological flexibility to reducing anxiety. The subsequent text outlines how this interpretation aligns with previous research. For instance, enhancing the processes within the 'Open' dyad could have been beneficial in reducing anxiety; cognitive defusion might have aided in detaching from irrational concerns (Baker & Berghoff, 2022; Bardeen & Fergus, 2016; Batten, 2011, p. 83; Cookson et al., 2020), while acceptance could have addressed experiential avoidance by increasing the willingness to encounter uncomfortable sensations associated with anxiety (Akbari & Khanipour, 2018; Baker & Berghoff, 2022; Bardeen & Fergus, 2016; Batten, 2011, p. 83; Cookson et al., 2020). Furthermore, in the 'Active' dyad, having clear values might have motivated individuals with anxiety, reinforcing that their efforts in defusion and exposure were worthwhile (Batten, 2011, p. 78). Especially that values and value-based committed actions have been shown to reduce anxiety (Räsänen et al., 2020; Wilson et al., 2010). Additionally, within the 'Aware' dyad, the process of 'being present' may have assisted in allowing thoughts to come and go without excessive attachment, focusing on the present moment rather than being preoccupied with thoughts of an undesired and feared future (Batten, 2011, p.88; Räsänen et al., 2020).

Concerning loneliness, the results of this study indicate a reduction in loneliness levels upon completing the intervention course. Although there is limited research examining the effects of digital ACT interventions on loneliness among university students, the findings of the current study are consistent with previous research on the effects of ACT interventions on loneliness in different demographics, whether through digital means (Zarling et al., 2023) or face-to-face interactions (Mahmoudpour et al., 2021; Ziaee et al., 2022). The reduction of loneliness observed after completing the intervention course can be attributed to the role of psychological flexibility. Loneliness is associated with higher levels of cognitive fusion, experiential avoidance, and low levels of committed actions (Castro et al., 2021). Therefore, fostering the opposing processes—cognitive defusion, acceptance, and committed action—would likely contribute to a decrease in loneliness. Additionally, a possible explanation could be that promoting value-based committed actions could have encouraged 'active solitude,' wherein individuals respond to feelings of loneliness by engaging in rewarding activities aligned with their self-chosen values, transforming their loneliness into a positive experience of aloneness. Another possible explanation is that acceptance (as opposed to experiential avoidance) might have facilitated greater exposure to social connections, and cognitive defusion could have reduced the negative overthinking associated with 'sad passivity'.

In the case of depression, the decrease in depression levels post-intervention was not statistically significant. This outcome does not align with previous research that suggests digital ACT interventions typically lower depression levels (Klimczak et al., 2023; Lappalainen et al., 2015, 2021a, 2021b, 2022; Thompson et al., 2021; Zhao et al., 2022). A possible interpretation of this result could be that the initial levels of depression in this dataset were already low. Generally, anxiety and depression are highly correlated (Jacobson & Newman, 2014), with anxiety often preceding (Rice et al., 2004) and contributing to the development of depression (Batterham et al., 2013) through mechanisms such as anhedonia (i.e., loss of pleasure) (Winer et al., 2017) and experiential avoidance (Jacobson & Newman, 2014). Therefore, while this study shows no significant effect on current depression levels, alleviating anxiety levels might potentially prevent the development of future depression, suggesting that the impact of ACT on mental health might extend beyond immediate effects. Overall, the results of this study demonstrate that this digital ACT intervention course promoted university students' psychological flexibility and mental health, as evidenced by increased mental well-being and decreased levels of anxiety and loneliness.

6.1 Impact on practice

The results of this digital Acceptance and Commitment Therapy (ACT)-based intervention course demonstrate the effectiveness of such interventions in enhancing mental health within university settings. Notably, the benefits of digital ACT interventions have been shown to extend beyond the immediate outcomes, maintaining their impact at follow-up (e.g., Klimczak et al., 2023). This illustrates the potential these interventions hold for shaping higher education practices and policies. Consequently, other universities may be motivated to prioritize mental health more prominently as a strategic goal and to develop similar courses.

A promising direction for expanding this digital intervention course is its adaptation into a Massive Open Online Course (MOOC) format. This modification would broaden its accessibility, reaching a wider student demographic, including those not enrolled at the University of Helsinki. Furthermore, offering the course in multiple languages could amplify its global impact, reaching a diverse array of student groups in higher education. Moreover, ACT based interventions, such as this course, has been using the technological advancements to be applied via digital platforms, mobile applications (Hoel et al., 2022), or even virtual reality (VR) (Gorinelli et al., 2023) to promote mental health. This approach of harnessing the growing advancement in technology for mental health is recommended by the WHO as it provides a scalable method to provide mental health support with more flexibility and less expenses and travel time (WHO, 2022a, p. 124). Therefore, future directions could also include modifying this intervention course to develop a version for mobile application to increase accessibility, whether for university students or the public.

Further educational implications involve supporting the development of psychological intervention courses tailored to students across various age groups and educational levels. Especially that WHO urges the education sector, as well as other sectors, to have an active role in developing evidence-based practices that address mental health at all life stages (WHO, 2021a, p. 5). This highlights the pivotal role of education in influencing mental health. Nevertheless, it is also critical to acknowledge that while the promotion of mental health often focuses on empowering individuals, a comprehensive approach to (mental) health promotion also requires social and political efforts (WHO, 2021a, p. v; WHO, 2021b, p. 4). Therefore, although psychological interventions are crucial for promoting mental health, they are complementary to, and not a replacement for, the broader social and political responsibilities toward individuals.

6.2 Limitations and future research

This study demonstrated that the digital ACT intervention course promoted psychological flexibility and mental health among university students. Despite these positive results, several limitations must be acknowledged. First, the generalizability of the findings is limited, as the sample was drawn solely from one Finnish university and included only students who voluntarily chose to participate. Additionally, there was a disproportionately high number of female (84.7%) and bachelor's (78.6%) students, along with uneven representation across various academic disciplines. Future research could mitigate these issues by collaborating with multiple universities.

A second limitation is the absence of a control group. Control groups are crucial as they provide insights into the outcomes when no intervention is applied (passive control) or when an alternative intervention is used (active control), facilitating a comparison with the tested intervention's effects (Moser, 2019). Including control groups not only helps validate the experiment but also assists in assessing the intervention's impact (Moser, 2019). However, despite the lack of a control group, the current study's findings still offer valuable insights into the potential changes of students' psychological flexibility and mental health during the digital ACT-based course and can aid in the development of hypotheses for further research.

Thirdly, the absence of follow-up measures means that the sustainability of the intervention's positive effects over time cannot be confirmed within this study. Future research could address this limitation by conducting longitudinal studies with a larger initial sample size, tracking students' mental health conditions over periods of 3, 6, and 9 months or longer. Furthermore, investigating the effectiveness of this intervention course when administered in various languages and to different populations could offer additional insights into the universality of this approach for promoting mental health among university students.

Despite these limitations, the study also demonstrates two main strengths. Firstly, it evaluates mental health by measuring both positive outcomes, in terms of mental well-being, and negative outcomes, including symptoms of anxiety, depression, and loneliness. This dual approach aids in gaining a comprehensive understanding of mental health status among university students. Secondly, this study investigates changes in 'loneliness' among university students after participating in the digital ACT-based intervention course. To the best of my knowledge, research on the effectiveness of digital

ACT interventions for loneliness among university students is scarce. Therefore, incorporating these outcome measures could offer valuable insights into the various potential contributions of digital ACT interventions to university students' mental health. Recommendations for future research include using a more diverse and larger sample size, utilizing a control group, and implementing randomized controlled trials (RCTs). Longitudinal follow-up studies and the exploration of course versions in various languages are also suggested.

6.3 Conclusion

The theoretical framework of ACT has consistently emphasized that the primary goal of ACT is not merely the reduction of symptoms, though that may occur, but rather the enhancement of psychological flexibility to foster a fulfilling, value-based life. The findings from this study indicate that this digital ACT intervention course significantly promoted psychological flexibility, while effects on mental well-being, anxiety and loneliness were smaller, with no significant impact observed on depression. The relatively larger effect size for psychological flexibility, compared to the other outcomes, aligns well with theoretical expectations of ACT. These results also underscore the vital importance of incorporating accessible psychological interventions into students' education. Thus, integrating these digital ACT interventions into the higher education curriculum could provide substantial support to the vulnerable population of university students. Additionally, it could be beneficial to adapt these interventions for integration into other educational curricula, such as those for school students and vocational training. This approach of integrating psychological support within educational frameworks across different stages not only alleviates students' distress but also helps them develop the skills of psychological flexibility, which are beneficial for leading more fulfilling lives. Highlighting the role of education as going beyond academic enrichment to also become a foundation for better mental health.

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Appendices

APPENDIX 1. Participants' characteristics (N=98)

Students' variable	Number of students (%)
Sex	
Female	83 (84.7%)
Male	13 (13.3%)
Non-binary	1 (1 %)
Did not say	1 (1%)
Educational Level	
Bachelor's student	77 (78.6%)
Master's student	20 (20.4%)
PhD student	1 (1%)
Faculties	
Faculty of Educational Sciences	20 (20.4%)
Faculty of Agriculture and Forestry	19 (19.4%)
Faculty of Science	18 (18.4%)
Faculty of Biological and Environmental Sciences	13 (13.3%)
Faculty of Pharmacy	9 (9.2%)
Faculty of Social Sciences	7 (7.1%)
Faculty of Arts	4 (4.1%)
Faculty of Theology	3 (3.1%)
Faculty of Medicine	2 (2%)
Faculty of Veterinary Medicine	2 (2%)
Swedish School of Social Science	1 (1%)
Marital Status	
Single	58 (59.2%)
Cohabitating	23 (23.5%)
Engaged	5 (5.1%)
Married	12 (12.2%)
Children	
No children	80 (81.6%)
One child	5 (5.1%)
Two children	8 (8.2%)
Three children	2 (2%)
Four children	2 (2%)
Did not say	1 (1%)
Household	
Living alone	43 (43.9%)
Living with their spouse and no children	25 (25.5%)
Living with their spouse and child/children	15 (15.3%)
Living with someone other than their spouse, children, or parents	10 (10.2%)
Living with their parents	4 (4.1%)
Living with their child/children (no spouse)	1 (1%)
Work status	
Unemployed	50 (51%)
Working < 10 h/week	29 (29.6%)
Working 10 h – 20 h /week	14 (14.3%)

Working > 20h/week	5 (5.1%)
Financial situation	
There is enough money and there is some left over	7 (7.1%)
The money is sufficient	37 (37.8%)
Must compromise to some extent on consumption	36 (36.7%)
Must compromise a lot on consumption, but manageable	15 (15.3%)
Must compromise on all consumption and cannot get by	3 (3.1%)