JYU DISSERTATIONS 739

Tetta Hämäläinen

Adolescents' Usage Activity, Adherence, and Gains from a Brief Online Acceptance and Commitment Therapy–Based Intervention to Promote Psychological Well-Being

UNIVERSITY OF JYVÄSKYLÄ
FACULTY OF EDUCATION AND PSYCHOLOGY

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ABSTRACT

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This dissertation investigated Finnish ninth-grade adolescents' usage activity, adherence, and gains in psychological well-being during a five-week online intervention based on acceptance and commitment therapy (ACT). Study I (n = 161) investigated antecedents of online ACT usage activity and intervention experiences. Study II (n = 161) examined adherence and usage activity in relation to well-being gains obtained during online ACT. Study III (n = 243) investigated the potential of online ACT in promoting adolescents' subsequent school engagement through its effects on well-being. Study I showed that female adolescents and adolescents with high self-regulation were more active users of the online ACT program and had more positive experiences of it. Four subgroups of adolescents were identified in the study based on their usage activity, perceived usefulness, and program satisfaction. Study II showed that higher gains in well-being were predicted by the extent to which participants followed the intended program usage. In addition, time spent in the program was shown to be important in relation to well-being gains. Three subgroups of adolescents were identified based on their adherence, usage activity and well-being gains: (1) "Adhered, committed users with relatively large intervention gains" (35%), (2) "Less committed users with no intervention gains" (42%), and (3) "Non-committed users with no intervention gains" (23%). Study III showed that the effects of online ACT to promote adolescent subsequent school satisfaction were mediated through decreased depressive symptoms. Overall, this dissertation showed that there were wide individual differences in intervention experiences, usage activity and outcomes of online ACT. This dissertation also highlighted adherence and usage activity as important contributors to intervention outcomes. Lastly, this dissertation found support for the applicability of online ACT in efforts to support adolescent mental health, which may also consequently promote subsequent school engagement.

Keywords: acceptance and commitment therapy, online interventions, adherence, usage activity, psychological well-being, adolescents

TIIVISTELMÄ (ABSTRACT IN FINNISH)

Hämäläinen, Tetta
Nuorten käyttöaktiivisuus, sitoutuminen ja hyvinvoinnillinen hyötyminen viisi viikkoa kestävästä hyväksymis- ja omistautumisterapiaan pohjautuvasta verkkointerventiosta
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Tämä väitöskirja tutki suomalaisten yhdeksäsluokkalaisten nuorten käyttöaktiivisuutta, käyttöön sitoutumista, ja saatuja psyykkisen hyvinvoinnin hyötyjä viisi viikkoa kestäneen hyväksymis- ja omistautumisterapiaan (HOT) pohjautuvan verkkointervention aikana. Osatutkimuksessa I (n = 161) kartoitettiin nuorten HOT-pohjaisen verkkointervention käyttöaktiivisuutta ja interventiokokemuksia ennakoivia tekijöitä. Osatutkimuksessa II (n = 161) selvitettiin ohjelmaan sitoutumisen ja käyttöaktiivisuuden yhteyksiä intervention aikana ilmenneisiin hyvinvoinnillisiin hyötyihin. Osatutkimuksessa III (n = 243) tarkasteltiin HOT-pohjaisen verkkointervention potentiaalia vaikuttaa nuorten myöhempään koulutukseen sitoutumiseen hyvinvoinnissa ilmenneiden muutosten kautta. Osatutkimuksessa I havaittiin, että erityisesti tytöillä sekä niillä nuorilla, joilla oli korkeammat itsesäätelyyn liittyvät taidot, ilmeni korkeampaa käyttöaktiivisuutta ja enemmän positiivisia kokemuksia. Käyttöaktiivisuuteen, koettuihin hyötyihin ja ohjelmaan tyytyväisyyteen perustuen tunnistettiin neljä alaryhmää. Osatutkimuksessa II myönteisten hyvinvoinnin muutosten havaittiin olevan yhteydessä siihen, missä määrin nuoret tekivät ohjelmassa suositeltuja tehtäviä ja kuinka paljon aikaa he käyttivät tehtävien tekemiseen. Tutkimuksessa löytyi kolme alaryhmää: (1) “Sitoutuneet ja suhteellisen paljon hyötyneet käyttäjät” (35%), (2) “Vähemmän sitoutuneet ja hyötyjä kokemattomat käyttäjät” (42%), ja (3) “Ei-sitoutuneet ja hyötyjä kokemattomat käyttäjät” (23%). Osatutkimuksessa III verkkointerventiolla havaittiin olevan epäsuora yhteys toisen asteen koulutuspaikkaan tyytyväisyyteen vähentyneiden masennusoireiden kautta. Väitöskirjan tulokset syventävät ymmärrystä nuorten yksilöllisistä eroista verkkointerventioiden käyttöaktiivisuudessa ja -kokemuksissa sekä interventiotuloksissa. Väitöskirjan tulosten mukaan verkkointervention käyttöön sitoutuminen ja käyttöaktiivisuus ovat tärkeässä roolissa sen suhteen, millaisia hyvinvoinnillisia hyötyjä nuori saa ohjelmasta. Tulokset myös osoittivat HOT-pohjaisten verkkointerventioiden olevan sovellettavissa nuorten hyvinvoinnin tukemiseen, mikä puolestaan voi tukea myös heidän myöhempää sitoutumista koulutukseen.

Avainsanat: hyväksymis- ja omistautumisterapia, verkkointerventio, sitoutuminen, käyttöaktiivisuus, psyykkinen hyvinvointi, nuoret

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FOREWORD

Studying psychology has proven to be one of the most interesting and fulfilling journeys for me, personally and career-wise. This dissertation marks an important milestone along that journey, and I have been fortunate to have amazing mentors, colleagues, friends, and family to share it with.

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Helsinki, December 11, 2023
Tetta Hämäläinen

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Taking into account comments and suggestions provided by the co-authors, the author of this dissertation wrote the original research plan and was the main author for all three original publications. The statistical analyses were conducted in collaboration between the author of this dissertation and the co-authors.

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ORIGINAL PAPERS

1 INTRODUCTION

Adolescence is a developmental phase that is filled with important milestones of identity forming, maturation, building autonomy, and evolving relationships and roles within family and with peers (Steinberg & Morris, 2001; World Health Organization, 2021). Adolescence has various definitions across sociocultural and historical contexts, but generally it can be attributed to begin with puberty and end when transitioning to adult roles (Curtis, 2015; Steinberg et al., 2018). Chronological definitions for adolescence and its substages vary in the literature; the present dissertation follows a definition where adolescence can be divided into early, middle, and late stages, covering the ages from around 11 to 25 years (Curtis, 2015; Salmela-Aro, 2011).

The present dissertation focuses especially on middle adolescents, aged around 15 to 16 years, who are reaching the end of basic education in the Finnish school system and entering the transition to upper secondary education. This time is characterized by important decisions regarding future education and are usually the first ones made based on personal interests. These decisions build the foundation for future education and career paths. Simultaneously, adolescents are in the middle of developmental tasks related to construction of a coherent identity, brain maturation, developing self-regulation, and increasing capacity for more complex cognitive tasks (Kiuru, 2023; Salmela-Aro, 2011; Steinberg et al., 2018).

Along with important changes and maturation, adolescence is also a time of vulnerability. Around half of all lifetime cases of mental health problems have been estimated to have their onset during childhood or adolescence (Kessler et al., 2005, 2007). Problems related to mental health can have a long-reaching adverse impact on health, life expectancy, quality of life, education, career paths, and time spent in the workforce (OECD, 2010; Schlack et al., 2021; Solmi et al., 2022; Suldo et al., 2014). At least one in every four adolescents has been estimated to be affected by mental health problems (Merikangas et al., 2010; Silva et al., 2020). This makes adolescents a crucial demographic to target interventions at. Fostering positive factors at a young age may increase resilience and protect from development of later problems related to mental health (Schlack et al., 2021).

Mindfulness-based interventions have been demonstrated to improve various outcomes for young people, including mental health, self-regulation, academic performance, and attentional focus (Phan et al., 2022). One approach that incorporates mindfulness and acceptance-based skills is acceptance and commitment therapy (ACT; Hayes et al., 1999). ACT represents a new wave of cognitive behavioral therapy that can be flexibly applied with groups or individuals (e.g., see Burckhardt et al., 2016, 2017; Coto-Lesmes et al., 2020; Hayes et al., 2010), across different age groups and various well-being issues (Dindo et al., 2017; Fang & Ding, 2020b). ACT has its foundations in therapeutic work in face-to-face form, but in previous years it has been adapted in online environments (O'Connor et al., 2018; Thompson et al., 2021). The potential of online ACT in promoting adolescent well-being has in recent years been explored by some randomized controlled trials (e.g., Karekla et al., 2022; Puolakanaho et al., 2019). However, available research concerning online ACT specifically for adolescents is yet scarce. As of the present dissertation, results of systematic PubMed and PsycNet searches for online ACT for adolescents show mostly studies conducted with adult populations or college or university students.

An important consideration in relation to online psychological intervention programs is adherence (i.e., the extent to which the intended usage of a program is being followed), which has been attributed as an important contributor to explaining intervention outcomes (Donkin et al., 2011; Kelders et al., 2012). In other words, increasing engagement or adherence to online intervention programs is considered as part of increasing the possibilities of positive gains in well-being (Donkin et al., 2013). Furthermore, it has been pointed out that intervention outcomes may not be dependent simply on program completion, but a sufficient amount of usage could lead to desired effects (Sieverink et al., 2017). Therefore, the relationship between engagement with or usage of online intervention programs and intervention outcomes is another important dimension to explore. Exploring these factors is important in understanding how and for whom online psychological interventions are the most beneficial. Consequently, the first aim of this dissertation was to obtain a novel understanding of the individual differences in adolescents' usage activity regarding their experiences of and responses to an online ACT intervention.

In addition to immediate intervention effects, another important aspect is maintaining the effects over the long term. The number of studies on ACT-based interventions for adolescent well-being that would also include follow-up is limited, but some recent studies have addressed this: face-to-face ACT interventions have shown effects that are maintained from three to five months (Burckhardt et al., 2017; Hayes et al., 2011) and online ACT interventions have shown effects that are maintained from one to six months (Karekla et al., 2022; Kiuru et al., 2021). Similarly, the effects of online ACT for university students' well-being have been found to persist for 12 weeks to one year after the intervention (Räsänen et al., 2016; Viskovich & Pakenham, 2020). Lately, some studies investigating the effects of ACT-based interventions on educational outcomes in addition to well-being outcomes have been published. Previous

studies have shown improvements in adolescent well-being and career preparation via online ACT-based intervention (Kiuru et al., 2021; Puolakanaho et al., 2019), and gains in university students' (Grégoire et al., 2016, 2018) and junior high school students' (Fang & Ding, 2020a) well-being and school engagement via group-based ACT interventions. Promoting adolescent mental health can make important contributions to their engagement with their studies and prevent dropping out of school (Garvik et al., 2014; Parviainen et al., 2020). Therefore, the second aim of this dissertation was to investigate the potential of an online ACT intervention in promoting adolescent school engagement through their increased psychological well-being.

1.1 Supporting mental health with online interventions

According to the definition by Hosman et al. (2004), mental health promotion and mental disorder prevention are two overlapping components that are situated under the general concept of mental health. In short, mental health promotion aims to increase individuals' well-being, competence, and resilience, whereas mental disorder prevention aims to reduce the symptoms of said disorder. An observed decrease in mental health disorders can also reflect a secondary outcome of prevention (Hosman et al., 2004). Therefore, mental health promotion and mental disorder prevention are interrelated, and strategies based on both approaches are often present in psychological interventions (Fusar-Poli et al., 2020). Similarly, this dissertation considers mental health promotion and mental disorder prevention as approaches that can be combined in an intervention to support adolescent mental health. Interventions can be offered in various forms and are usually divided into universal and selective interventions (Fusar-Poli et al., 2020). Universal interventions target a whole population, whereas selective interventions target individuals or subgroups that have been identified as being at-risk for developing disorders. This dissertation focuses especially on universal interventions, but interventions targeting specific clinical symptoms have also been included in the literature review.

Interventions that promote adolescent well-being are at the heart of buffering against possible emerging mental health problems. However, only a small proportion of adolescents in need of professional help receive or seek it (Sheppard et al., 2018). Several issues seem to contribute to this problem. First, the most common reasons that prohibit adolescents from seeking help are stigma or attitudes related to mental illnesses, preference for self-management, and fear of asking for help or not being taken seriously (Gulliver et al., 2010; Sheppard et al., 2018). Thus, services should be designed to cater to adolescent needs of self-management, reduce stigma, and increase the ability to recognize early symptoms of mental health problems (Gulliver et al., 2010; Radez et al., 2021). Second, many adolescents live in a situation where their access to mental health services is prevented by other factors such as their economic situation or inconveniences in scheduling or traveling (Ritterband et al., 2009). Moreover,

despite being able to independently seek information and support, adolescents still often depend on adults to actually gain access to professional help (Steinberg, 2002). Lastly, especially the time of the COVID-19 pandemic has seen a rapid increase in mental health-related complaints among adolescents (Harrison et al., 2022; Ma et al., 2021). Overburdened treatment facilities and the inability to provide accurately timed support may lead to worsening symptoms and a higher threshold to seek help. Overall, there is a need to increase the availability of low-threshold mental health services for adolescents, which requires solutions to be as cost-effective and easily accessible as possible. One possible solution to this could be found by providing services online (World Health Organization, 2020).

Technology has a long history of assisting in healthcare (e.g., Bloom, 1992; Dasta et al., 1992; Klingler et al., 1976), but literature concerning intervention programs that target especially psychological well-being outcomes has possibly experienced its greatest growth during the last few decades (e.g., Cuijpers et al., 2008; Eysenbach, 2002). The concept of eHealth refers to the use of information and communication technology (ICT) for health, where mHealth represents a component of it as health supported with mobile devices (WHO Global Observatory for eHealth, 2011). The present dissertation is located under the umbrella of eHealth by using the term *online psychological intervention programs* to refer to web applications that target psychological outcomes and can be accessed or downloaded via a browser with devices that have an Internet connection.

Online psychological intervention programs vary greatly in terms of their length, structure, content, and the amount of offered guidance or contact during the intervention. Intervention periods can vary between programs, commonly from a few sessions to several months in length (Arnberg et al., 2014; Etzelmueller et al., 2020; Stasiak et al., 2016). Guidance offered by, for example, a clinician or a coach also varies between programs from reminders or minimal supportive feedback (e.g., in form of text messages) to frequent face-to-face meetings (i.e., blended intervention), or the intervention programs may be completely self-administered. Self-administered as well as guided interventions have been demonstrated to have the potential of leading to positive gains (Bisby et al., 2022). However, the effects of guided interventions have been shown to be bigger compared to self-administered interventions (Andersson & Cuijpers, 2009; Grist et al., 2019).

Guided online psychological intervention programs are considered as effective as face-to-face therapies (Andersson et al., 2019). However, online interventions have some advantages compared to face-to-face interventions. First, online interventions may help in lowering barriers and increase access to services for people living in low-resource and high-stigma situations (Pachankis et al., 2020). Second, most adolescents are familiar with different digital technologies and use them daily, so they are likely to already possess required skills to use online intervention programs. Lastly, the Internet enables distribution of information on a large scale and programs can be used regardless of time or location, which increases availability and accessibility (Gladstone et al., 2015; Wallin et al., 2016). However, online interventions have their limitations as well:

high attrition or dropout rates are commonly reported in studies regarding online interventions and users may not use the provided programs or technology as was intended by their design (Kelders et al., 2020). Low engagement with interventions is associated with reduced intervention effects, and challenges in engagement with and motivation for treatment are common in adolescents (Gearing et al., 2012; Kyngäs, 2007).

Overall, research shows that adolescents need evidence-based mental health interventions, and online-based intervention programs may be one possible option for this. It seems that online interventions hold the potential of reaching groups within the adolescent population who may have previously been overlooked, such as those concerned with stigma, cost, or accessibility to mental health services (Johnson et al., 2022; Pachankis et al., 2020). An important aspect in making online psychological intervention programs effective is to prevent participant dropout and maintain motivation by making the programs engaging (Short et al., 2015). One aspect of making interventions engaging is the possibility of tailoring or personalization (Jahedi et al., 2022; Neil et al., 2009; Yardley et al., 2016), which would require flexibility from not only the program, but also from the program's content. One example of a form of psychotherapy that is regarded as a method that is flexible, approachable, and applicable across a range of conditions is acceptance and commitment therapy (ACT).

1.2 Theoretical background: Acceptance and commitment therapy

1.2.1 ACT as a third wave of cognitive behavioral therapy

Acceptance and commitment therapy (ACT; Hayes et al., 1999) builds on *functional contextualism* (e.g., Biglan & Hayes, 1996) and Relational Frame Theory (RFT; see Dymond & Roche, 2013). Functional contextualism is a variety of pragmatism that sees psychological events as constant interactions between whole organisms and contexts defined by history and situations (Hayes et al., 2006). The aim in functional contextualism is to predict and influence with precision, scope, and depth (Hayes, 2004; Hayes et al., 2006). In turn, RFT is a contextualistic theory of cognition, according to which relational frames (i.e., relationships between concepts formed through language and cognition) can facilitate humans to learn things and form verbal rules that govern behavior (Hayes, 2004; Prevedini et al., 2011; Stewart & Roche, 2013). The ability to verbally process and transform functions can have both positive and negative effects on us (Stewart & Roche, 2013).

According to Hayes (2004), the term "third wave" refers to ACT and other mindfulness and acceptance-based therapies being preceded by, first, traditional behavior therapy, and, second, cognitive behavioral therapy (CBT; see e.g. Beck, 1993). ACT represents a part of CBT, but has different features compared to it (Ruiz, 2012). Like CBT, ACT considers language to be relevant in

psychopathology (Hayes et al., 2006). However, instead of analyzing or changing the content of thoughts and feelings, ACT focuses on their functions and context (Hayes, 2004; Ruiz, 2012). In other words, the target of ACT is to increase the repertoire of responses to thoughts and feelings (Pielech et al., 2017). Reducing symptoms or changing the content of cognitions is not a priority in ACT, but these are things that may occur during it (Ruiz, 2012). Another key feature of ACT is its focus on increasing engagement to actions that are based on personal values, that is, things that add meaning and importance to one's life (Hayes, 2004; Pielech et al., 2017).

In ACT, the key source of suffering is *psychological inflexibility* (Hayes et al., 2006). Inflexibility refers to the inability to persist or change behavior to a direction that aligns with one's personal values (Bond et al., 2011; Hayes et al., 2006). Inflexibility includes fusion with evaluative or self-defeating thoughts, disengagement and disconnection from the present, and experiential avoidance, all of which contribute to rigidness that distracts from pursuing a meaningful and fulfilling life (Bond et al., 2011; Harris & Hayes, 2019). The aim in ACT is to increase *psychological flexibility*. Contrary to inflexibility, flexibility refers to skills of maintaining contact with the present moment, being aware and accepting of thoughts and emotions, and committing to actions that align with one's values (Hayes et al., 2010; Hayes et al., 2006). Psychological flexibility consists of six core processes: values, value-based actions, contact with the present moment, acceptance, cognitive defusion, and self-as-context (Hayes et al., 2006; see Figure 1 for the adaptation of the model of psychological flexibility and inflexibility).

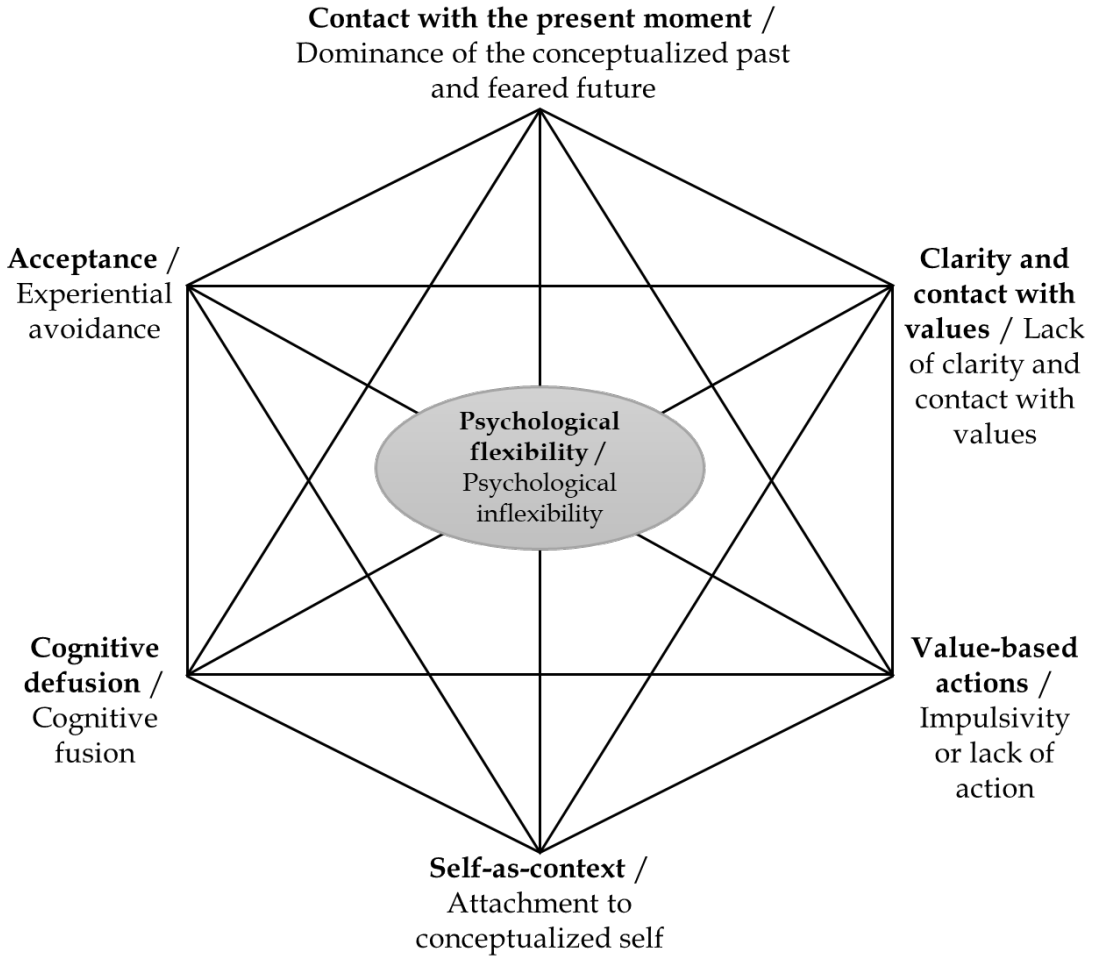

FIGURE 1 ACT model of psychological flexibility (Hayes et al., 2006).

Within the six core processes, values refer to meaningful and important things that can be embodied behaviorally, by committing to value-based actions (Hayes, 2004; Petersen et al., 2022). That is, doing things that guide us towards what is personally meaningful and important. More concrete, achievable goals can be set after the clarification of values. Contact with the present moment refers to the ability to observe internal experiences in an ongoing and non-judgmental manner, that is, paying attention to thoughts and emotions that emerge in this very moment without assessing them as being "good" or "bad" (Halliburton & Cooper, 2015; Petersen et al., 2022). Acceptance deals with the willingness to openly welcome inner experiences without attempting to change them (Hayes et al., 2006). From an ACT perspective, avoidance is a key feature in mental health issues and acceptance serves as its alternative (Hayes et al., 2010). The process of cognitive defusion refers to the ability to take distance, that is, diminishing the attachment to thoughts and feelings in order to see the world outside of internal experiences (Petersen et al., 2022). Self-as-context deals with gaining perspective on the self as the context where thoughts and feelings occur (Hayes et al., 2010). The six core processes are interrelated and overlapping, and can be seen to represent two groups: mindfulness and acceptance processes (acceptance,

cognitive defusion, self-as-context, and contact with the present moment) and commitment and behavior change processes (values, value-based actions, self-as-context, and contact with the present moment). Self-as-context and contact with the present moment represent both groups simultaneously, because the now as known is associated with all human psychological activity (Hayes et al., 2006).

ACT can be applied for various target populations, in various formats and settings. It is a transdiagnostic approach, meaning that it can be used to treat a range of conditions, such as mood and anxiety disorders, obsessions and compulsions, eating disorders and body dissatisfaction, chronic conditions, and pain (Dindo et al., 2017; Öst, 2014; Thompson et al., 2021). ACT is also flexible in its delivery, as it can be applied in single-session or one-day workshops (Dindo et al., 2017; Dochat et al., 2021) as well as in longer treatment periods (e.g., Heffner et al., 2002), which allows the planning and delivery of the interventions to meet the needs of the target populations. ACT has also been applied in various settings such as with psychiatric inpatients (Petersen & Zettle, 2009; Tyrberg et al., 2017) and outpatients (Pahnke et al., 2019; Pinto et al., 2017), at workplaces (Flaxman et al., 2013; Moran, 2015), and in education (Grégoire et al., 2018; Levin et al., 2020; Räsänen et al., 2016; Takahashi et al., 2020). ACT has received considerably more research attention regarding its applicability with adult populations, but the literature has grown in volume regarding ACT with younger age groups as well (e.g., Hayes & Ciarrochi, 2015).

1.2.2 ACT for adolescents

A distinctive developmental characteristic for adolescence (that is, covering ages of around 11 to 25; Curtis, 2015) is an increase in sensation seeking, which has been estimated to reach its peak at around 19 years of age (Steinberg et al., 2018). When combined with still developing self-regulation, which, in turn, continues into the mid-20s, this can produce behavioral patterns that underline impulse-based and avoidant short-term responses to emotionally difficult situations (Petersen et al., 2022; Steinberg et al., 2018). In addition, attempts from adults to externally regulate emotionally difficult situations, which may be helpful with smaller children, may be rejected by an adolescent (Burckhardt et al., 2016). From an ACT perspective, increasing psychological flexibility may help in building metacognition, decision making, self-awareness, and recognition of different thoughts and emotions (Burckhardt et al., 2016; Halliburton & Cooper, 2015; Petersen et al., 2022). ACT offers a way for adolescents to explore what they value in life and discover behaviors that are consistent with their values (Hayes & Ciarrochi, 2015). It can help to expand responses to adversities and accept the occurrence of unwanted or unpleasant thoughts and emotions as a natural part of life (Halliburton & Cooper, 2015).

Some developmentally sensitive considerations should first be addressed before applying ACT with adolescents. First, exercises are recommended to be experiential and interactive, which can be enabled with activities such as art, workbooks, and role plays (Halliburton & Cooper, 2015; Kingery et al., 2006;

Livheim et al., 2015). This enables cognitive metaphors to become more concrete and helps adolescents to target their energy towards something constructive instead of requiring them to suppress it. Second, the use of age-appropriate language reinforces comprehension; for example, as done by Wicksell et al. (2005), thoughts and sensations related to chronic pain can be expressed through "the pain monster" in order to distance oneself from them. Finally, adolescents' own interests and hobbies can be used as a foundation for ACT-based exercises, which can also reinforce motivation to treatment (Halliburton & Cooper, 2015; Kingery et al., 2006).

ACT has been successfully implemented for adolescents aged around 12 to 18 years in face-to-face and group forms for several mental health problems, including depression and anxiety (Hayes et al., 2011; Livheim et al., 2015), stress (Livheim et al., 2015), PTSD (Woidneck et al., 2014), and anorexia nervosa (Heffner et al., 2002; see also systematic reviews by Fang & Ding, 2020b and Swain et al., 2015). Applying ACT in a school context has shown promising results with interventions for school staff (Jeffcoat & Hayes, 2012) and adolescents aged 12 to 18 years (Burckhardt et al., 2016, 2017; Livheim et al., 2015; Takahashi et al., 2020), though ACT interventions delivered by teachers in class have shown mixed results (Van der Gucht et al., 2017). Research on ACT in school settings is still recent and requires more highly powered studies before drawing firmer conclusions on their effects or generalizability with early- to middle adolescence people (Fang & Ding, 2020b; Knight & Samuel, 2022). However, additional information can be drawn from studies investigating ACT interventions for college and university students. Thus far, studies have supported the feasibility of ACT interventions in supporting students' well-being, lowering symptoms of mental health problems, and increasing engagement in their studies (Grégoire et al., 2018; Katajavuori et al., 2021; Levin et al., 2014, 2015; Räsänen et al., 2016).

ACT can also be applied in an online environment. Online ACT intervention programs on adult well-being outcomes have received considerably more attention in research (e.g., see Brown et al., 2016; Kelson et al., 2019; Lappalainen et al., 2021a), but interest has lately grown concerning the possibilities of supporting adolescent well-being with online ACT interventions. Previous studies have investigated the effects of online ACT on adolescent anxiety (Zemestani et al., 2022), eating disorder symptoms (Karekla et al., 2022), depressive symptoms and life satisfaction (Lappalainen et al., 2021b), experiential avoidance (Keinonen et al., 2021), stress and academic buoyancy (Puolakanaho et al., 2019), and career preparation (Kiuru et al., 2021). All of these online ACT intervention programs have been five to eight sessions or modules long, and the effect sizes on well-being outcomes have varied from small to large. Overall, there is less research literature available on adolescent populations, but online ACT intervention programs seem like a viable option in promoting adolescent well-being and reducing symptoms of mental health problems.

1.3 Antecedents of commitment to and intervention experiences in online ACT for adolescents

In the context of ACT principles, adherence can be linked with value-based behavior, where committing to an intervention stands as an act made in service of personal values (Graham et al., 2022; Zhang et al., 2018). In the context of online interventions, various definitions for commitment, engagement, and adherence exist in the literature, and establishing a consensus on the exact definitions is an ongoing process (Donkin et al., 2011; Karekla et al., 2019; Sieverink et al., 2017). The literature has acknowledged the importance of adherence to online interventions and factors that would anticipate it have been the target of growing interest (Donkin et al., 2011; Manwaring et al., 2008; Neil et al., 2009). Investigating predictors of adherence is important in establishing who is more likely to commit to an online psychological intervention program and how the programs should be tailored for adolescent users (Puolakanaho et al., 2023), thus increasing the possibilities of positive intervention outcomes. However, knowledge regarding factors that would predict adherence or engagement specifically in online psychological interventions for adolescents remains limited, even more so in the context of online ACT. The aim in Study I was to address this gap by examining different individual and environmental factors that may anticipate adolescent commitment to (i.e., the extent of online intervention program usage) or experiences of (i.e., the level of intervention satisfaction and perceived usefulness) an online ACT intervention.

Individual antecedents refer to personal characteristics such as temperament, gender, and the level of psychological well-being. Higher adolescent adherence has previously been associated with higher self-regulation skills (Berg et al., 2014; Shalev & Geffken, 2015) and academic achievement (Lillevoll et al., 2014). Results regarding gender have been mixed, as in some studies females have shown higher adherence than males have (Batterham et al., 2008; Garrido et al., 2019; Neil et al., 2009), while in other studies gender was unrelated to adherence (Calear et al., 2013; Pellerin et al., 2010). Baseline symptom severity has also received mixed results: some studies have indicated that having more depressive symptoms at baseline would predict adherence (Batterham et al., 2008; Calear et al., 2013; Neil et al., 2009) while others have suggested the opposite (Christensen et al., 2009; Kristensen et al., 2018). Similarly, higher baseline anxiety has been suggested to predict adherence (Batterham et al., 2008), but also opposing results have been reported (Neil et al., 2009; Spence et al., 2019). *Environmental antecedents* refer to the characteristics of a person's surroundings, such as interpersonal relationships and possible conflicts in them. Previous studies have shown that higher adherence to treatment may be predicted by social support from family and friends (Pihlaskari et al., 2018; Spence et al., 2019; Taddeo et al., 2008) and practitioners (Kyngäs & Rissanen, 2001). In turn, higher experienced conflict in family relations and lower socioeconomic status (SES) have been associated with lower adherence (DeLambo et al., 2004; Hall et al., 2023; Shemesh

et al., 2018). Greater commitment to an intervention has been shown to be associated with more positive perceptions of intervention programs (Rickwood et al., 2019). Adolescent perceptions of online ACT-based intervention programs (Nicolaou et al., 2022; Puolakanaho et al., 2019) and other, mostly CBT-based programs, seem generally positive (March et al., 2018; Rickwood et al., 2019; Sweeney et al., 2019).

Overall, the previous literature seems to support the view that several individual and environmental antecedents may predict commitment to, satisfaction with, and perceived usefulness of online psychological intervention programs. However, previous studies have predominantly investigated intervention programs aimed at decreasing specific symptoms, such as depression or anxiety. Less is known if interventions that aim to promote well-being and psychological flexibility demonstrate similar associations.

In addition to examining associations between antecedents and intervention commitment and experiences, i.e., a variable-based approach, a person-oriented approach may be used to further analyze individual-based differences. In a person-oriented approach, variables are addressed as simultaneously interacting components that form a profile or a group (Bergman et al., 2003; Raufelder et al., 2013). The value of using a person-oriented approach alongside a variable-oriented approach is, therefore, that it puts the individual at the center of the research (Yardley et al., 2015). The results may carry important practical implications on how online interventions should take personalization into account. Personalization, or tailoring, is regarded as an important aspect of intervention engagement and outcomes (Jahedi et al., 2022; Neil et al., 2009; Orji, 2014). Understanding what predicts higher commitment and better intervention experiences may offer vital information on who is more likely to commit to and, consequently, benefit from online psychological intervention programs.

1.4 Adherence, usage activity, and gains in psychological well-being from online ACT

Research regarding online interventions has, thus far, demonstrated that adolescent mental health can be supported and treated with online psychological interventions (Clarke et al., 2015), including online ACT-based interventions (Karekla et al., 2022; Kiuru et al., 2021; Lappalainen et al., 2021b; Puolakanaho et al., 2019). However, a common issue related to online interventions has been the problem of low adherence, which has been suggested as one explanation for low or limited intervention effects (Kelders et al., 2012). A commonly used definition for adherence is that it refers to the extent to which a person's behavior corresponds with agreed recommendations given by a health care provider (Sabaté, 2003). However, this definition, as such, may not be sufficient to capture what adherence includes in the context of online interventions. One suggested definition, also followed in the present dissertation, is that adherence refers to

"intended usage", that is, the extent to which an online psychological intervention program is used as recommended by its design (Donkin et al., 2011; Kelders et al., 2012; Sieverink et al., 2017). Additionally, the present dissertation examined usage activity, which was approached as the extent to which participants used the online psychological intervention program in relation to all program content (Couper et al., 2010; Morrison et al., 2014; Perski et al., 2017).

Despite different approaches to and conceptualizations of adherence within the literature, studies regarding both face-to-face (Becker et al., 2015; Donkin et al., 2011; Hogue et al., 2008; Nock & Ferriter, 2005) and online (Hedman et al., 2013; Hilvert-Bruce et al., 2012; Manwaring et al., 2008; March et al., 2018) treatments have supported the connection between adherence and outcomes. In other words, those showing higher adherence to interventions are also more likely to experience greater gains in their well-being. Nevertheless, adherence and outcomes do not seem to possess a simply linear connection (Donkin et al., 2013). Lately, research has encouraged the examination of "effective engagement", that is, what constitutes a sufficient amount of usage that is connected to significant intervention outcomes (Pham et al., 2019; Sieverink et al., 2017).

In addition to multiple definitions, different measures have been used to assess participants' adherence to or engagement with online psychological intervention programs. These include indicators for frequency, intensity, time, and type, such as number of logins, module or exercise completion rates, usage time or days, and completion of exercises that require a user's own input or watching/reading information (Bijkerk et al., 2022; see also Barisic et al., 2011; Montoye, 2000). A previous study by Lappalainen et al. (2021b) discovered that adolescents who had completed at least three out of five modules of an online ACT intervention program showed better intervention outcomes compared to the control group. Similarly, studies with adult participants found effects of online ACT on well-being and psychological flexibility to be associated with higher usage time and greater number of sessions, exercises, usage days and weeks (Mattila et al., 2016), as well as a higher number of logins (Van Gemert-Pijnen et al., 2014). Additional information can be drawn from CBT-based online intervention studies, which have reported intervention outcomes to be associated with total usage time, and a higher number of exercises, modules, logins, and web page use (Donkin et al., 2011; Enrique et al., 2019; Gan et al., 2021; Smith & Liu, 2020).

Overall, the literature strongly supports the view that higher adherence to online psychological interventions is connected to greater gains in well-being. All users may not, however, need to experience all program content to obtain well-being gains, so program completion or non-completion should not be regarded as the sole indicator for adherence (Donkin et al., 2011; Sieverink et al., 2017). The research literature has identified multiple adherence indicators to associate with intervention outcomes, but most of this information concerns adult populations. The present dissertation aimed to contribute to knowledge regarding adolescent engagement and motivation to online psychological intervention programs and

their outcomes by assessing what kind of program usage is related to positive well-being gains in psychological well-being in an online ACT intervention program.

1.5 Online ACT, psychological well-being, and school engagement

Thus far, ACT-based interventions have been demonstrated to have positive effects on adolescent well-being. However, another important aspect to consider is the maintenance of intervention effects. From an ACT-based perspective, health behavior changes and increasing psychological flexibility are considered central in maintaining long-term intervention effects (Zhang et al., 2018). However, few studies that would examine immediate and long-term effects of ACT-based interventions on adolescent well-being are available. Hayes et al. (2011) found that an ACT-based group intervention for depressed 12 to 18 year old adolescents with a three-month follow-up showed greater effects as better improvement in depressive symptoms compared to treatment as usual (TAU), whereas effects on global functioning were similar between the ACT and TAU groups. Burckhardt et al. (2017) discovered that a preventive group-based ACT delivered in school had moderate to large effects on students' (14–16 years old) psychological symptoms and well-being from baseline to a five-month follow-up. Kiuru et al. (2021) showed that a brief online ACT intervention program had moderate effects on adolescents' (mean age 15 years) career preparation, with effects on maintaining at six-month follow-up. Karekla et al. (2022) discovered that an online ACT intervention compared to waitlist control had large effects on 13- to 25-year-old girls' eating disorder symptoms, with effects on maintaining at the one-month follow-up.

In addition to long-term mental health outcomes, the effects of ACT-based interventions on educational outcomes have been the focus of growing interest. Lately, the possibilities of ACT-based interventions in promoting school engagement (commonly divided into emotional, behavioral, and cognitive engagement; see also Appleton et al., 2008; Finn & Zimmer, 2012; Fredricks et al., 2004) have been investigated on different educational levels. Grégoire et al. (2016, 2018) found in two studies that compared to waitlist control, an ACT-based workshop led university students to achieve greater gains in their school engagement, psychological well-being, and psychological flexibility. Fang and Ding (2020a) showed in their study that junior high school students (mean age 13 years) experienced greater gains in their school engagement and psychological capital (i.e., self-efficacy, optimism, hope, resilience) after a five-week ACT-based group intervention compared to the control group. Katajavuori et al. (2021) found that university students experienced an increase in skills in managing time and stress, studying, and coping with negative thoughts after an online ACT-based intervention program. The relationship between student mental health and

school engagement is strongly supported by prior research. Studies have demonstrated that higher well-being is associated with higher school engagement (Awang-Hashim et al., 2015; Huebner & Gilman, 2006; Lewis et al., 2011; Yuen, 2016), whereas lower well-being is associated with lower school engagement and higher risk of school dropout (Garvik et al., 2014; Parviainen et al., 2020; Sagatun et al., 2014). School dropout is regarded to be the result of a gradual process involving feelings of disengagement and disconnection, so interventions that target the promotion of school engagement also buffer against risk of dropping out (Appleton et al., 2008; Hennig Manzuoli et al., 2019). Mental health problems have been shown to contribute to the risk of dropout (Hjorth et al., 2016).

Based on the previous literature, ACT-based interventions seem to hold the potential of supporting school engagement and mental health of students. It also seems possible that changes that occur in psychological well-being could mediate the effects of ACT on later school engagement (Fang & Ding, 2020a; Grégoire et al., 2018). Research addressing these processes in more detail are, however, lacking. Previous studies on mediational processes involving school engagement have shown that connection between well-being and dropout has been mediated by grade points (Sagatun et al., 2014) and self-perceived academic competence (Quiroga et al., 2013). The connection between stressful life events and school engagement was found to be mediated by psychological flexibility and psychological capital (i.e., self-efficacy, optimism, hope, and resilience; Fang & Ding, 2023). The present dissertation aimed to contribute to knowledge concerning the associations between psychological well-being and school engagement by addressing both the levels of and changes in psychological well-being in relation to later school engagement. In addition, the effects of online ACT intervention on adolescent school engagement and whether this effect is mediated by changes in psychological well-being were investigated. Increasing students' engagement to their studies is important in buffering the risks of dropout, promoting the pursuit of educational goals, and building careers that are in line with one's future aspirations.

1.6 Aims of the original studies

The aim of this dissertation was to investigate adolescents' usage activity, adherence, and gains from a brief online ACT-based intervention promoting psychological well-being. First, a person-oriented approach was applied to obtain a novel understanding of individual differences in (a) adolescents' usage activity and their satisfaction with online ACT and in (b) adolescents' usage activity and their response to an online ACT intervention in terms of well-being changes. Second, the potential of online ACT to promote adolescents' subsequent school engagement through their increased psychological well-being was investigated.

Study I examined how individual and environmental antecedents may predict adolescents' usage activity, intervention satisfaction, and perceived usefulness (i.e., learning skills related to mindfulness, acceptance, and values) of a brief guided five-week online ACT intervention program. In Study I, usage activity, and therefore, commitment to intervention, was reflected by the extent to which the participants used the program (see also Perski et al., 2017). A person-oriented approach was used to further examine emerging user subgroups based on their usage activity, satisfaction, and perceived usefulness. In addition, the associations of individual and environmental antecedents with identified subgroups were examined.

Study II examined how adherence to and usage activity in an online ACT intervention program is related to obtained gains in psychological well-being (i.e., increased life satisfaction and decreased stress). A person-oriented approach was used to investigate emerging patterns based on program adherence, usage, and well-being gains.

Study III examined the connections of an online ACT intervention program, psychological well-being, and subsequent school engagement. These processes were examined during participants' crucial educational transition from the final grade of basic education to upper secondary education. This was done by, first, examining the extent to which psychological well-being (i.e., life satisfaction and depressive symptoms) and changes in psychological well-being during ninth grade were associated with school engagement at the beginning of upper secondary education. Second, effects of online ACT were examined directly to school engagement and indirectly to school engagement through well-being changes. Gender and academic achievement were used as covariates in all of Study III's models.

2 METHOD

2.1 Participants and procedure

The participants of this dissertation were Finnish adolescents (n = 249, mean age 15 years, 49% female) who were randomly drawn from the broader longitudinal STAIRWAY – From Primary to Secondary School study (www.jyu.fi/stairway). Most of the participants spoke Finnish as their mother tongue (n = 230, 95%), and some (n = 12, 5%) were bilingual (Finnish and another language) or spoke a language other than Finnish as their mother tongue (one case missing). Many of the participants lived with both of their biological parents (n = 167, 69%), some lived alternately with their mother and father (n = 38, 16%), and some lived in other arrangements (n = 34, 14%), such as with a biological parent and stepparent, with one parent, or in foster care (four cases missing). The participants took part in a randomized controlled trial investigating a five-week ACT-based online psychological intervention program called the Youth Compass (see section 2.1.4 for the description of the program). The randomized controlled trial was conducted in the fall of the ninth grade (2017), that is, the final year of basic education. The participants were then followed regarding their school engagement one year later, in the fall of 2018 after the transition to upper secondary education. The Ethical Committee of the University of Jyväskylä has approved the study and it has been registered at ClinicalTrials.gov (NCT03274934). Written consent was gathered from the participating adolescents and their guardians.

Participant recruitment and randomization was conducted in two steps (see also Figure 2). First, the inclusion criteria for the intervention study were that the participant was part of the STAIRWAY sample, had given their written consent to take part in the intervention study, and was a Finnish speaker. Second, the included participants were randomly allocated by an independent researcher to either an intervention group with online support and minimal face-to-face

contact (iACTface, *n* = 83), an intervention group with online support (iACT, *n* = 82), or a control group (*n* = 84). Online support and face-to-face contact with the participants were provided by personal coaches (*n* = 31, 83% female), who were bachelor's or master's level psychology students. The coaches received 18 hours of ACT training prior to the intervention and had access to a weekly supervision provided by a licensed psychologist during the intervention. Figure 2 illustrates the flow of the studies' participants.

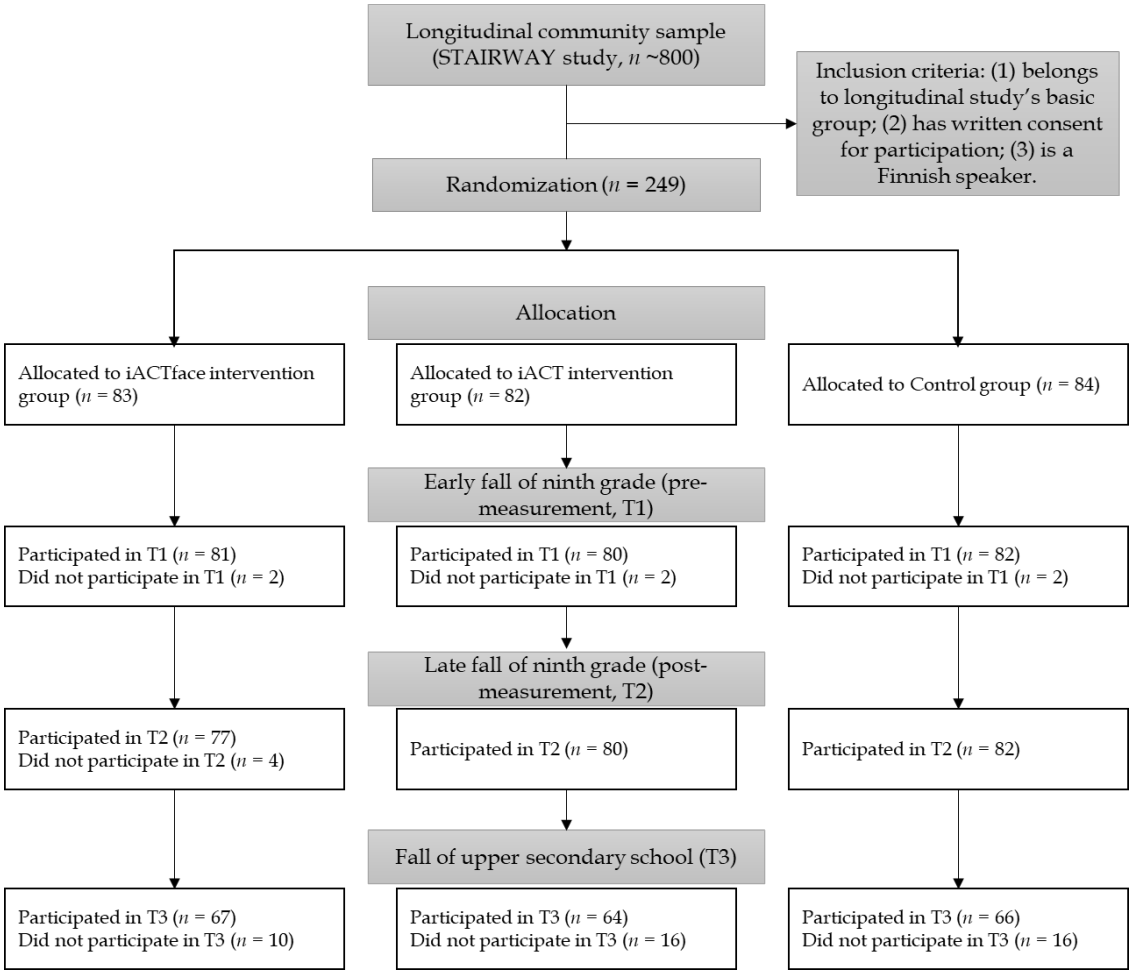

FIGURE 2 Participant flow chart.

Six participants withdrew from the study after allocation and before pre-measurement. Information on the participants' individual and environmental antecedents and self-reported psychological well-being were gathered in the early fall (September–October) of ninth grade (i.e., pre-measurement, T1). Next, the five-week Youth Compass intervention was carried out for the iACTface and iACT intervention groups. Log data on adherence and usage activity in the intervention program was automatically recorded during the intervention and was retrieved for analysis after the intervention was completed. Next, self-reports on the experiences of the Youth Compass intervention (i.e., satisfaction and perceived usefulness of the program) and psychological well-being were

gathered after the intervention, in the late fall (October–November) of ninth grade (i.e., post-measurement, T2). The time interval between pre- (T1) and post-measurement (T2) was seven weeks. Lastly, data on participants' school engagement were collected one year later, after the transition from basic education to upper secondary level education (T3). In this dissertation, the iACTface and iACT intervention groups were analyzed as one combined group (n = 161), because the form of support offered by coaches (online support and face-to-face contact vs. online support only) during the intervention did not seem to affect adherence or outcomes. That is, the intervention groups did not statistically significantly differ in terms of adherence, usage activity, psychological well-being, or intervention outcomes (p > .05 for all). In this dissertation, studies I and II investigated the intervention participants between pre- and post-measurement (T1 and T2, n = 161). In turn, Study III investigated the intervention participants and control group participants at all three time points (T1, T2, and T3, n = 243; see also Table 1 for the studies' overview).

TABLE 1 Summary of the original studies' aims and methods.

Study	Aims	Measurement points	Variables	Analysis methods
Study I	- Associations of individual and environmental antecedents with usage activity and intervention experiences. - Identifying subgroups based on usage activity and intervention experiences; associations of subgroup membership with antecedents.	T1: Early fall of ninth grade (intervention group; *n* = 161) T2: Late fall of ninth grade (*n* = 157)	Usage activity: Usage days Intervention experiences: Satisfaction with intervention, Perceived usefulness Individual antecedents: Gender, Temperamental effortful control, Academic achievement, Stress, Life satisfaction, Depressive symptoms Environmental antecedents: Parents' education levels, Peer acceptance/rejection, Closeness to mother/father, Conflict with mother/father, Closeness to teacher, Conflict with teacher	Variable-oriented: Correlations, Regression Person-oriented: Latent profile analysis (LPA)
Study II	- Associations of adherence and usage activity with gains in psychological well-being. - Identifying subgroups based on adherence, usage activity, and gains in psychological well-being.	T1: Early fall of ninth grade (intervention group; *n* = 161) T2: Late fall of ninth grade (*n* = 157)	Adherence: Adherence percentage Usage activity: Completion percentage, Usage time (minutes), Usage weeks Psychological well-being: Stress, Life satisfaction	Variable-oriented: Correlations, Regression Person-oriented: *K*-means cluster analysis, Tukey HSD post hoc
Study III	- Psychological well-being and changes in psychological well-being predicting later school engagement. - The extent to which a brief guided online ACT intervention program predicts adolescents' subsequent school engagement through increased well-being.	T1: Early fall of ninth grade (intervention group + control group; *n* = 243) T2: Late fall of ninth grade (*n* = 238) T3: First year of upper secondary school (*n* = 197)	Psychological well-being: Life satisfaction, Depressive symptoms School engagement: School satisfaction, Dropout intentions Covariates: Gender, Academic achievement	Latent growth model (LGM), LGM with distal outcome variable, LGM with indirect effects

2.1.1 The iACTface group (Studies I, II, and III)

Before the intervention, the iACTface intervention group participants had face-to-face meetings with their coaches, which were around 45-minute-long structured interviews concerning the adolescents' current life situation. The interview structure was adapted from the psychosocial interview template by Strosahl et al. (2012). The iACTface participants then received oral instructions and an instruction sheet with credentials on the Youth Compass intervention program. During the intervention, the participants received online support in the form of encouraging and motivating instant text messages. The first part of the messages was the same each week: "How are you doing? Please rate your mood during the last week on a scale from 4 to 10 (4 = very bad, 10 = very good)." The second part of the message depended on the intervention week's theme (see "Online support from coach" in Table 2). After the intervention, the iACTface participants had a second meeting with their coaches. The meeting after the intervention focused on discussing the participants' experiences of the intervention.

2.1.2 The iACT group (Studies I, II, and III)

The iACT intervention group received the same Youth Compass intervention program with the same online support from their coaches as participants in the iACTface intervention group did, but they did not have face-to-face meetings with their coaches. The iACT group participants received a brief introduction to the intervention program, credentials, instructions, an instructions sheet, and an intervention timetable.

2.1.3 The control group (Study III)

The control group received school counseling and healthcare as usual and did not receive the Youth Compass intervention or coach support.

2.1.4 The intervention program

The Youth Compass is a five-week online ACT-based intervention program designed to promote adolescent mental health and skills related to well-being and interpersonal relationships. The design of the program's content was based on ACT intervention models for adolescents (Ciarrochi et al., 2012; Hayes & Ciarrochi, 2015) and previous experiences from the randomized controlled trial of an online ACT intervention for university students (the Student Compass; see Räsänen et al., 2016). From an ACT perspective, behavioral changes are facilitated by comprehension of personal values and defining goals and actions that align with them (Ciarrochi et al., 2012). One of the aims in ACT exercises is to help adolescents explore and identify what is important to them, and to incorporate them into everyday life. This can be done by making the exercises experiential,

interactive, and as close to adolescent's own interests and life as possible (Halliburton & Cooper, 2015; Kingery et al., 2006).

Before conducting the intervention study, the Youth Compass intervention program underwent multiple pilot tests with adolescents who provided feedback about the program. The program was then modified based on the feedback (e.g., theoretical content was reduced and language was simplified).

The Youth Compass intervention program consisted of five modules, one per week, each presenting a different ACT-based theme (see Figure 3 and Table 2). Each module consisted of an introduction and three sections that contained exercises. The program's exercises were designed to take a few minutes each, five at maximum, and most of them were provided in audio and written forms. The program content included short texts, audio and video clips, and comic strips. A module was marked done when a user completed two mandatory exercises in each section (six exercises in total). Additional exercises were also available in all sections for participants to complete if they wanted. The participants in the present study were instructed to complete the mandatory exercises during the intervention period. This meant spending around 15 to 30 minutes per week in the program.

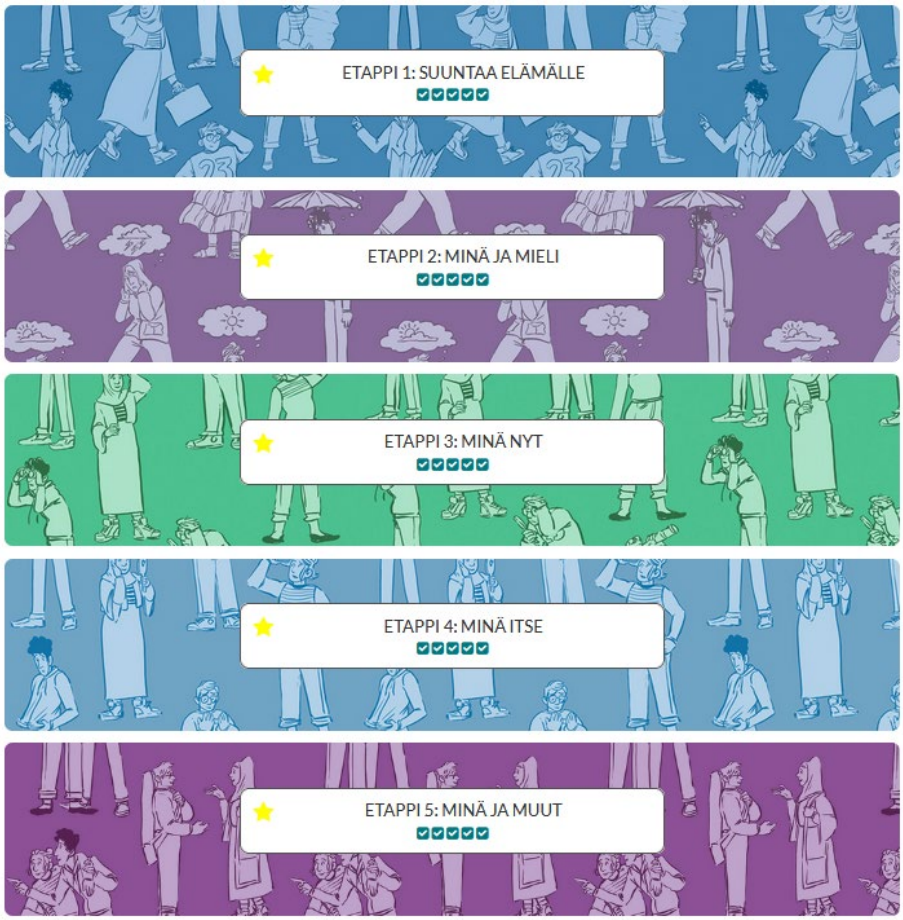

FIGURE 3 Screenshot of the Youth Compass program modules.

TABLE 2 Structure and content of the Youth Compass intervention.

Module, theme, related ACT processes	Sections	Online support from coach
Introduction: Brief orientation to the program.		
1) Direction for life: Recognizing personal interests and examining possible obstacles. Taking action towards valuable goals. *ACT process: Values*	i) What is important to me? ii) What do I want to achieve? iii) What stops me?	What is important to you? What could you do today or tomorrow to add joy and energy to your life? Do it!
2) Me and my mind: Promoting self-awareness and acceptance of thoughts, feelings, and memories. Taking an observational perspective on them. *ACT process: Cognitive defusion*	i) Mind is like… ii) Distance to thoughts iii) Testing thoughts	You can choose how to relate to your own thoughts. Try to act differently from what your mind suggests. See what happens. What could you do that provided you energy this week?
3) Me now: Taking a standpoint regarding thoughts and feelings, learning mindfulness and applying these skills in everyday life. *ACT processes: Present moment and acceptance*	i) Observe ii) In this moment iii) Testing out in practice	What kinds of skills (related to being in the moment) you have used in your everyday life? What kinds of consequences did you observe while using them?
4) Me and myself: Perceptions of oneself, recognizing self as a context, and learning to take a different perspective. *ACT processes: Self-as-context and self-compassion*	i) My own story ii) Changing perspective iii) Friend to yourself	Kindness toward self is important. How can you treat yourself kindly (in a similar manner as your friend who has difficulties)?
5) Me and other people: Promoting good interpersonal relationships, applying actions to one's social life. *ACT processes: Value-based actions and compassion towards others*	i) Friend to yourself and others ii) In the world iii) Challenging situations	What kinds of good things have you done for other people in the past week, or what could you do next week?

Note. Online support was provided by personal coaches. The first part of the coaches' messages was the same each week: "How are you doing? Please rate your mood during last week on a scale from 4 to 10 (4 = very bad, 10 = very good)." The second part of the message depended on the intervention week's theme (see above).

2.2 Measures

Overall, Study I used measures for individual and environmental antecedents (see sections 2.2.1 and 2.2.2), intervention experiences (see section 2.2.3), and usage activity (see section 2.2.4). Study II used measures for adherence, usage activity (see section 2.2.4), and psychological well-being (see section 2.2.5). Study III used measures for psychological well-being (see section 2.2.5) and school engagement (see section 2.2.6). See also Table 1 for the overview of the original studies.

2.2.1 Individual antecedents (Study I)

Gender. Gender was coded as a binary variable based on sex assigned at birth.

Temperamental effortful control. A short version of the revised Early Adolescent Temperament Questionnaire (EATQ-R; Capaldi & Rothbart, 1992; Ellis, 2002; translation to Finnish by K. Räikkönen-Talvitie and colleagues) was used as self-report to assess adolescents' temperament and self-regulation skills.

Academic achievement. Adolescents were asked to self-evaluate their grade point average (self-reported grades correlate highly with actual grades, see also Sainio et al., 2019). The grade range in the Finnish school system is from 4 to 10, where the lowest passable grade is 5.

Study I also used stress, life satisfaction, and depressive symptoms as individual antecedents. See section 2.2.5 for the description of these measures.

2.2.2 Environmental antecedents (Study I)

Level of parents' education. Participants' parents reported their highest obtained degree on a scale from 1 to 7 (1 = no vocational training; 7 = postgraduate degree, i.e., licentiate or doctorate).

Peer acceptance and rejection. A sociometric nomination procedure was used to measure acceptance and rejection of peers (see also Bukowski et al., 2012). Participants nominated up to six peers on the same grade level with whom they most like to spend time (positive nominations) and with whom they would least like to spend time (negative nominations) during school days. The nominations are then standardized, where positive nominations represent acceptance and negative nominations represent rejection.

Closeness to and conflict with parents. The Child-Parent Relationship Scale (CPRS; Driscoll & Pianta, 2011) was used for assessing participants' experiences of their relationships with mothers and fathers. The scale consists of five items for closeness and six items for conflict, which are answered on a scale from 1 to 5 (1 = not true at all; 5 = completely true).

Closeness to and conflict with teacher. The participants assessed their relationship with teacher using the Student-Teacher Relationship Scale (STRS-Short Form; Pianta, 2001). The scale consists of five items for closeness and six

items for conflict, which are answered on a scale from 1 to 5 (1 = not true at all; 5 = completely true).

2.2.3 Intervention experiences (Study I)

Intervention satisfaction. The participants evaluated their level of satisfaction with the Youth Compass intervention program by answering how satisfied they were with the Youth Compass experience in general and how satisfied they were with the intervention program. The questions were answered on a scale from 4 to 10 (4 = very unsatisfied; 10 = very satisfied).

Perceived usefulness. Participants evaluated their perceptions of the usefulness of the Youth Compass intervention by answering seven statements on a scale from 4 to 10 (4 = I haven't learned at all; 10 = I have learned very much) regarding how much they learned mindfulness, acceptance, and value-related skills during the intervention.

2.2.4 Usage activity and adherence (Studies I and II)

Usage days (Study I). Number of separate days during the intervention period when the participant had accessed the Youth Compass program.

Usage time (Study II). Total usage time in minutes was calculated as the cumulative time between timestamped log entries. Long breaks of over 10 minutes were excluded from the cumulative time, except for long breaks that were clearly associated with program exercises that required saving longer texts or watching/listening longer exercises.

Usage weeks (Study II). Measured as the number of separate weeks during which the participant accessed the Youth Compass program, that is, regardless of the number of accesses during that week.

Completion percentage (Study II). A percentage that was calculated based on the number of exercises the participant completed in relation to all program content, including recommended and voluntary exercises.

Adherence percentage (Study II). A percentage that was calculated based on the number of exercises the participant completed in relation to recommended program usage. The participants were recommended to complete six exercises per week, that is, 30 exercises in total during the intervention period. Doing voluntary exercises did not affect the adherence percentage.

2.2.5 Psychological well-being (Studies I, II, and III)

Stress (Studies I and II). Stress was first explained as "a situation where people feel tensed, restless, nervous, or anxious and have difficulties sleeping due to the things wandering in their mind" and participants answered the question "Do you feel this kind of stress at the moment?" on a scale from 1 to 6 (1 = not at all; 6 = very much; see also Elo et al., 2003).

Life satisfaction (Studies I, II, and III). The Finnish version of the Satisfaction with Life Scale (SWLS; Diener et al., 1985; see also Mauno et al., 2018;

Pavot et al., 1991) was used to measure participants' life satisfaction. The scale consists of five items that are answered on a scale from 1 to 5 (1 = completely disagree; 5 = completely agree). A higher mean score between items refers to higher satisfaction with life.

Depressive symptoms (Studies I and III). The Depression Scale (DEPS; Salokangas et al., 1994, 1995; see also Kiuru et al., 2012; Salmela-Aro et al., 2009; Tuominen-Soini, 2012) consists of 10 items that the participants answered on a scale from 0 to 3 (0 = not at all; 3 = very much). A higher total score on the item refers to greater severity of depressive symptoms. The scale has demonstrated its validity in screening for and predicting depression in primary care settings (Poutanen et al., 2007, 2010).

2.2.6 School engagement (Study III)

School satisfaction. Participants answered on a scale from 1 to 5 (1 = not at all; 5 = very much) their levels of satisfaction with their current place of upper secondary education (see also Vasalampi et al., 2018). Mean scores over the four items are then calculated, where a higher value indicates higher school satisfaction.

Dropout intentions. On a scale from 1 to 5 (1 = not at all; 5 = very often), participants answered two items ("Have you considered changing your school or field of study?", "Have you considered quitting your current school or field of study?"; see also Parviainen et al., 2020; Vasalampi et al., 2018) concerning their intentions to drop out of their place of upper secondary education.

2.3 Statistical analyses

In Study I, first, individual and environmental antecedents' associations with usage activity (i.e., number of usage days) and intervention experiences (i.e., intervention satisfaction, perceived usefulness) of the online ACT-based intervention program were examined. This was done by investigating correlations and conducting regression analyses (i.e., a variable-oriented approach) using the IBM SPSS Statistics software (version 26). Second, a person-oriented approach was used to identify subgroups of adolescents based on their usage activity and intervention experiences. This was done by conducting latent profile analysis (LPA; Muthén & Asparouhov, 2006; Vermunt & Magidson, 2002) using the Mplus (version 8.4, Muthén & Muthén, 1998–2017) software. LPA seeks subgroups of individuals that share similarities within groups but differ across groups. The approach is model based, that is, the models can be tested and their goodness of fit assessed (Raufelder et al., 2013). Different indices were used in selecting the group solution produced by the analyses: the fit of the model, the average latent class probabilities and the number of participants located in each group, and the practical usefulness, theoretical justification, and interpretability of the subgroup solution (Bauer & Curran, 2003; Muthén, 2003). Model fit was

evaluated using the Bayesian information criterion (BIC), the Lo-Mendell-Rubin adjusted likelihood ratio test (aLRT), the Vuong-Lo-Mendell-Rubin likelihood ratio test (VLMR), and the Bootstrap Likelihood Ratio Test (BLRT; McLachlan & Peel, 2000). Lastly, an Mplus auxiliary function with the BCH method (Asparouhov & Muthén, 2014a, 2014b) was used to compare the identified subgroups in relation to individual and environmental antecedents. The comparisons were based on Wald Chi-square test of statistical significance.

In Study II, all analyses were conducted with IBM SPSS Statistics software (version 26). First, correlations and regression analyses were used to investigate associations of adherence and usage activity with adolescents' gains in psychological well-being and the extent to which gains may be predicted with adherence and usage activity. Multiple measures for adherence and usage activity (i.e., adherence percentage, completion percentage, usage time, and usage weeks) were used in the study to reflect the multidimensional nature of engagement (Michie et al., 2017). Second, a person-oriented approach was used to identify subgroups of adolescents based on their adherence, usage activity, and well-being gains. This was done by conducting a *K*-means cluster analysis, which is a commonly used partitioning-based method for identifying subgroups (Sarstedt & Mooi, 2019). The cluster analyses were conducted by setting adherence (i.e., adherence percentage), usage activity (i.e., completion percentage, usage minutes, usage weeks), and well-being gains (i.e., change in life satisfaction, change in stress) as determinants for cluster formation. Multiple cluster solutions were explored, because the number of clusters must be specified before running the analysis. Selecting the appropriate group solution was based on examining number of participants in each group within each solution, the number of iterations, analysis of variance (ANOVA), and the variance ratio criterion (VRC; Caliński & Harabasz, 1974; Sarstedt & Mooi, 2019). Lastly, the subgroups within the selected solution were compared with each other in terms of well-being and changes in well-being by using Tukey HSD post-hoc test.

In Study III, all analyses were conducted with Mplus software (version 8.4). The first aim of Study III was to examine the extent to which adolescents' levels of and changes in psychological well-being during the fall of ninth grade predict subsequent school engagement in the first year of upper secondary education. The second aim of Study III was to examine the extent to which an online ACT intervention delivered during ninth grade predicts subsequent school engagement through its effects on well-being. Latent growth modeling (LGM; see also Duncan & Duncan, 2004, 2009) was used to examine the participants' initial levels of (i.e., intercepts) and changes in (i.e., slopes) life satisfaction and depressive symptoms during the fall of ninth grade, that is, from pre-measurement (T1) to post-measurement (T2). LGM with two time points enables estimation of change and between individuals and the amount and direction of change (Duncan & Duncan, 2009). Next, school engagement in the first year of upper secondary education (T3) was added to the model as a distal outcome variable (see also Smid et al., 2020). In the model, school engagement in the first year of upper secondary education was predicted by initial levels of and changes

in psychological well-being during the fall of ninth grade. The first model investigated individual differences in associations between psychological well-being and school engagement, regardless of whether a participant was allocated to the Youth Compass intervention group or the control group. The effects of online ACT intervention were taken into account in the next step when investigating the direct and indirect effects of the intervention (groups coded as 0 = control group, 1 = intervention group) on school engagement through increased well-being. The final model included only the statistically significant associations. The significance was examined with bootstrapping (1,000 bootstrap resamples) and 95% confidence intervals (CI). Gender and academic achievement were used as covariates in all analyses to control for their potential effects. Model fit was evaluated with chi-square test (χ^2), the comparative fit index (CFI), and standardized root mean square residual (SRMR; see also Hooper et al., 2008; Hu & Bentler, 1999).

3 SUMMARY OF THE RESULTS

3.1 Study I

Study I had three aims. First, to investigate the extent to which participants' individual and environmental antecedents were associated with their commitment to and intervention experiences of online ACT-based Youth Compass program. Second, to identify subgroups of participants based on their usage activity and experiences of the online ACT intervention program (i.e., person-oriented approach). The third and last aim was to investigate the extent to which individual and environmental antecedents were associated with participants' membership of each identified subgroup. Individual antecedents included gender, temperamental effortful control, academic achievement, stress, depressive symptoms, and life satisfaction. Environmental antecedents included level of parents' education, peer acceptance, peer rejection, closeness to and conflict with parents, and closeness to and conflict with teacher. Commitment was measured as usage activity, represented as the number of separate days a participant accessed the intervention program. Intervention experiences included self-evaluated level of satisfaction with the program and level of perceived usefulness (i.e., learning of mindfulness, acceptance, and value-related skills).

In the study, 82% of adolescents were moderately to highly active in using the intervention program and assessed their perceived usefulness and satisfaction with the program as average to high. The results regarding the first aim of Study I (i.e., associations of antecedents with intervention commitment and experiences) showed that higher commitment (i.e., usage activity) to and better experiences (i.e., satisfaction and perceived usefulness) of the intervention program were associated with female gender and lower experienced conflict with teacher. In addition, usage activity was associated with higher temperamental effortful control and academic achievement, and higher initial level of stress. Intervention satisfaction was associated with higher academic

achievement, peer acceptance, and closeness with mother. Perceived usefulness was associated with higher temperamental effortful control, peer acceptance, and closeness with parents and teacher. In turn, depressive symptoms, life satisfaction, peer rejection, conflict with parents, and parents' level of education were not associated with commitment to or experiences of the Youth Compass program. Regression analyses showed that, after controlling for the effects of all antecedents, gender and effortful control were the only significant predictors of intervention commitment and experiences.

Regarding the second aim of Study I (i.e., identifying subgroups of adolescents based on their usage activity and intervention experiences), four subgroups were identified in the latent profile analysis (LPA; see Figure 4). The following names were given to the groups based on their characteristics: *Satisfied* (n = 65, 41%) showed average usage activity and high satisfaction and perceived usefulness. *Dissatisfied* (n = 29, 18%) showed low activity and very low satisfaction and perceived usefulness. *Active* (n = 12, 8%) showed very high usage activity and average satisfaction and perceived usefulness. Lastly, *Moderate* (n = 51, 33%) showed average usage activity, satisfaction, and perceived usefulness.

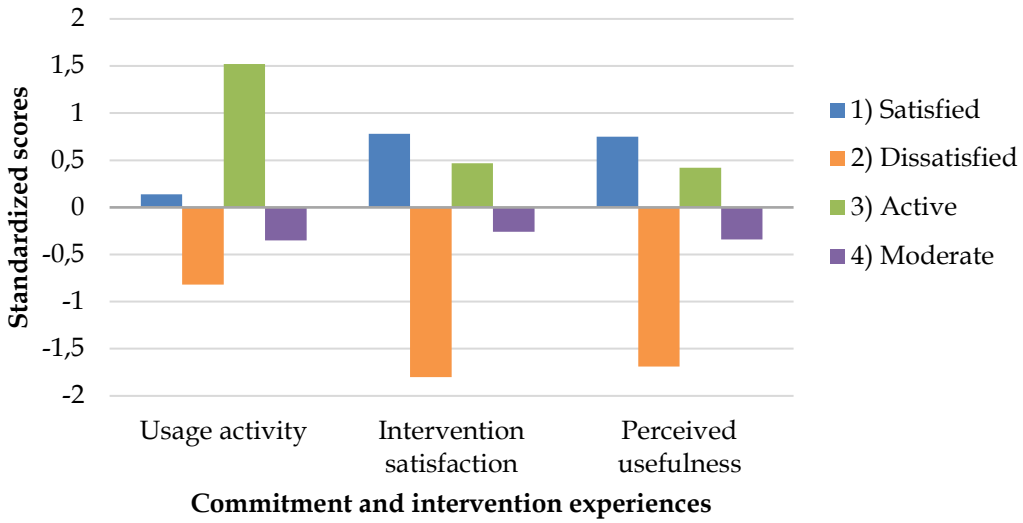

FIGURE 4 Adolescent subgroups based on commitment to and experiences of online ACT.

Regarding the third aim of Study I (i.e., associations of individual and environmental antecedents with subgroup membership), the Dissatisfied group had significantly more males than the other three groups did. The Active group adolescents had higher academic achievement compared to the Dissatisfied and Moderate groups. Adolescents in the Satisfied and Moderate groups showed higher adolescent–mother closeness compared to the Dissatisfied group. Adolescent–teacher closeness was higher in the Satisfied group compared to the Dissatisfied group. Adolescent–teacher conflict was lower in the Active group compared to the other three groups and adolescent-teacher conflict was higher in the Dissatisfied group compared to the other three groups. Some pairwise differences were also discovered: adolescents belonging to the Dissatisfied group

showed lower levels of stress compared to the Active group, and lower effortful control, lower peer acceptance, and lower levels of adolescent–father closeness compared to the Satisfied group. No significant differences were found between any of the groups in terms of depressive symptoms, life satisfaction, parents' education level, peer rejection, or conflict with parents.

Overall, Study I showed that commitment to and intervention experiences of an online ACT-based intervention program were associated with multiple individual and environmental antecedents. Especially being of female gender and having higher temperamental effortful control skills predicted higher commitment to the program and better intervention experiences. Additionally, higher school grades and positive interpersonal relationships associated with higher commitment and positive intervention experiences. In turn, perceived conflict with teacher were related to lower intervention commitment and experiences. Based on the results regarding psychological well-being, it was concluded that adolescents with varying levels of life satisfaction and depression symptoms may be as likely to commit to online ACT intervention, but especially adolescents with higher levels of stress seem more likely to commit to it compared to their less stressed counterparts.

3.2 Study II

Study II had two aims. The first aim was to investigate the extent to which adherence and usage activity predict gains from the online ACT-based Youth Compass program. The second aim was to identify subgroups based on adherence, usage activity, and gains in psychological well-being (i.e., person-oriented approach). Adherence was measured as a percentage in relation to intended usage (i.e., the extent to which a participant used the program as was recommended). Usage activity was measured with completion percentage in relation to all content, usage time in minutes, and usage weeks. Gains in psychological well-being were examined with changes in life satisfaction and stress; positive changes were represented by increased life satisfaction and decreased stress and negative changes were represented by decreased life satisfaction and increased stress.

The results regarding the first aim of Study II (i.e., the roles of adherence and usage activity in predicting intervention gains) showed that participants who had higher adherence percentage were more likely to experience higher stress before the intervention and experience an increase in their life satisfaction during the intervention. Participants who completed more exercises in the program were more likely to experience an increase in life satisfaction. Higher experienced stress before intervention were associated with higher usage time, whereas more usage weeks were associated with higher stress levels before and after the intervention. Adherence and usage activity measures were found not to correlate with changes in stress or life satisfaction levels before or after the intervention. Regression analyses indicated an effect from adherence to changes

in life satisfaction, meaning that participants who followed the intended usage of the online ACT intervention were more likely to experience an increase in their life satisfaction. Usage activity measures showed no effects on changes in life satisfaction and neither usage activity nor adherence showed effects on changes in stress in the regression analyses.

Results concerning the second aim of Study II (i.e., identifying subgroups based on adherence, usage activity, and well-being gains) showed that a three-group solution fit the data best. The group names and characteristics were as follows: *Adhered, committed users with relatively large intervention gains* (n = 52, 35%; showed high adherence, high completion and usage time, increased life satisfaction, and decreased stress), *Less committed users with no intervention gains* (n = 63, 42%; showed high adherence, high completion, used less time in program, no change in life satisfaction, and increased stress), and *Non-committed users with no intervention gains* (n = 35, 23%; showed low adherence and usage and no changes in life satisfaction or stress). Comparisons of the groups showed that Adhered, committed users with relatively large intervention gains obtained significant improvement in their life satisfaction, whereas the other two groups experienced no significant changes. Changes in stress were different for all three groups: Adhered, committed users with relatively large intervention gains experienced a significant decrease, Less committed users with no intervention gains experienced an increase, and Non-committed users with no intervention gains experienced no changes (see also Figure 5).

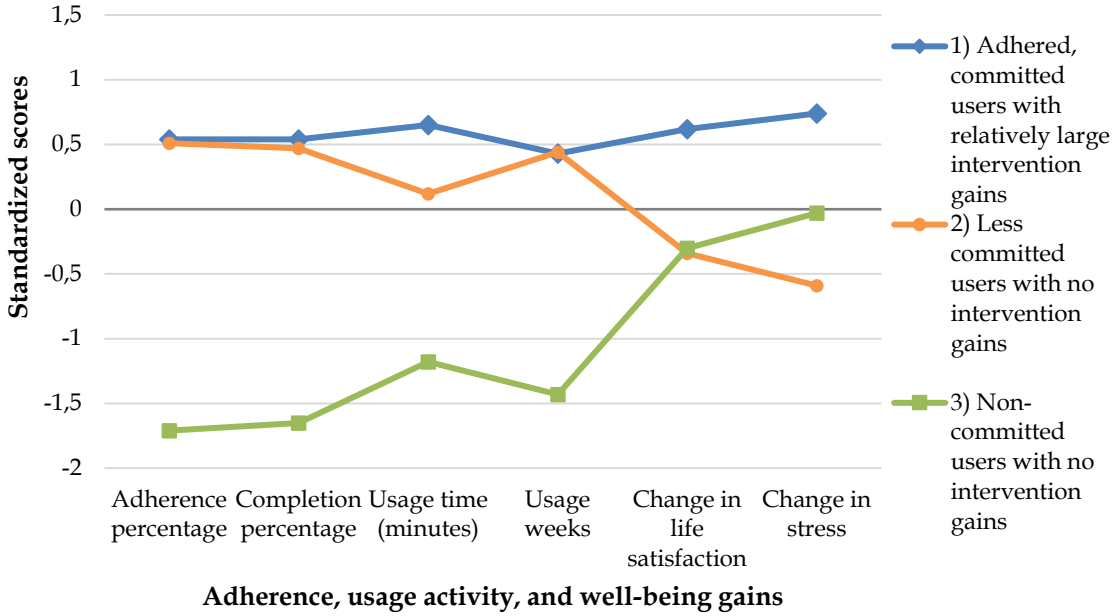

FIGURE 5 Adolescent subgroups based on adherence, usage activity, and well-being gains.

Additional comparisons were made between the Adhered, committed users with relatively large intervention gains and Less committed users with no intervention gains to investigate why the two groups seemed to show similar patterns of adherence and usage activity but showed different intervention gains.

Comparisons of variances showed that the groups differed significantly ($p < .001$) in terms of usage time. Adhered, committed users with relatively large intervention gains had an average of 126.72 minutes (approximately 24–25 min per intervention week) and Less committed users with no intervention gains had an average of 94.07 minutes (approximately 18 min per intervention week). This difference in time investment was suggested to contribute to why otherwise similar adherence and usage patterns may show as different results in terms of intervention gains.

Overall, Study II showed that the highest gains from the online ACT intervention program were most likely obtained when the program was used as intended by its design. This would mean following the instructed pace of the program and doing the recommended exercises, as shown by the variable-oriented results. Additionally, the person-oriented results showed that time investment and engagement in doing exercises seem as important as following the intended usage. It was concluded that online ACT-based intervention programs have the potential to promote adolescent psychological well-being, but more attention should simultaneously be paid to how to motivate commitment to and sufficient time investment in online interventions.

3.3 Study III

Study III had two aims. The first aim was to investigate the extent to which adolescents' initial levels of and changes in psychological well-being during the last grade of basic education (i.e., ninth grade) were associated with their school engagement after the transition to upper secondary education. The second aim was to examine the extent to which an online ACT intervention program delivered during ninth grade was associated with adolescents' subsequent school engagement through changes in their psychological well-being (see also Figure 6). Psychological well-being was measured with life satisfaction and depressive symptoms. School engagement was measured with self-reported levels of satisfaction with the current place of education and intentions to drop out of the current place of education.

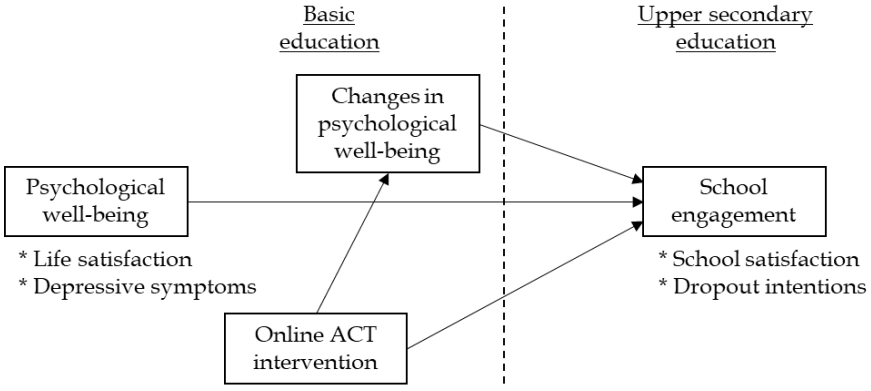

FIGURE 6 A conceptual model illustrating the aims of Study III.

The results concerning the first aim of Study III (i.e., predicting subsequent school engagement with life satisfaction and depressive symptoms) showed that a higher initial level of life satisfaction at the early fall of ninth grade predicted higher school satisfaction and lower dropout intentions at upper secondary education level. An increase in depressive symptoms during the fall of ninth grade predicted lower school satisfaction and higher intentions to drop out in the first year of upper secondary education. In turn, the initial level of depression symptoms in the early fall of ninth grade and changes in life satisfaction during the fall of ninth grade were not significantly associated with subsequent school engagement. The first aim was examined by including all participating adolescents in the model, regardless of whether they received the Youth Compass intervention or were in the control group. Regarding the second aim of Study III (i.e., assessing the effects of online ACT on school engagement through changes in well-being), one significant indirect effect was detected. In the model, online ACT was found to have an indirect effect on school satisfaction (but not dropout intentions) through decreased depression symptoms. In turn, life satisfaction was not found to mediate the effects of online ACT on school engagement and no direct effects were detected from online ACT on school engagement.

Overall, the results of Study III showed that psychological well-being and changes in psychological well-being during the final year of basic education are associated with school engagement after the transition to upper secondary education. In addition, the results showed that a brief guided online ACT intervention may increase adolescent psychological well-being, which can, in turn, support later school engagement. The results were concluded to support promotion of adolescent well-being during crucial educational transitions as it may be an important contributor to students' engagement with studies and dropout prevention, and that an online ACT intervention program may be one possible method to provide this support.

TABLE 3 Summary of the studies' main findings.

Study	Aims	Results
Study I	1. Individual and environmental antecedents' associations with usage activity and intervention experiences of the online ACT intervention. 2. Identifying subgroups based on usage activity and intervention experiences. 3. Associations of subgroup membership with individual and environmental antecedents.	1. Especially being of female gender and having higher temperamental effortful control skills predicted higher commitment to the program and better intervention experiences. 2. Four subgroups of adolescents were identified: Satisfied (41%), Dissatisfied (18%), Active (8%), and Moderate (33%). 3. Higher school grades and positive relationships with parents and teacher were associated with membership of groups with higher commitment to and positive experiences of online ACT. Male adolescents were overrepresented in the Dissatisfied profile compared to the other three profiles.
Study II	1. Associations of adherence to and usage activity in the online ACT intervention with gains in psychological well-being. 2. Identifying subgroups based on adherence, usage activity, and gains in psychological well-being.	1. Following the intended usage (i.e., adherence) of the online ACT intervention predicted gains in psychological well-being. 2. Three subgroups of adolescents were identified: *Adhered, committed users with relatively large intervention gains* (35%) showed high adherence, high program completion rates and used the program for around two hours in total; experienced an increase in life satisfaction, and a decrease in stress. *Less committed users with no intervention gains* (42%) showed high adherence and high completion rates but used significantly less time in program (around 90 minutes in total); experienced no change in life satisfaction and an increase in stress. *Non-committed users with no intervention gains* (23%) showed low adherence and usage rates; experienced no changes in life satisfaction or stress.
Study III	1. Psychological well-being and changes in psychological well-being during basic education (ninth grade) predicting school engagement at upper secondary level. 2. The extent to which the online ACT intervention predicts adolescents' later school engagement through increased well-being.	1. A higher initial level of life satisfaction during basic education predicted higher school engagement at upper secondary level. In turn, an increase in depressive symptoms during basic education predicted lower school engagement at upper secondary level. 2. Online ACT intervention during basic education predicted a decrease in depressive symptoms, which, consequently, was associated with higher satisfaction to place of upper secondary education.

4 GENERAL DISCUSSION

This dissertation investigated adolescents' usage activity, adherence, and well-being gains from a brief guided online ACT intervention. A person-oriented approach was applied to obtain novel understanding regarding individual differences in adolescents' usage activity in, experiences of, and well-being responses to online ACT. In addition, the potential of online ACT to promote adolescents' subsequent school engagement through their increased psychological well-being was investigated. First, Study I assessed how individual and environmental antecedents may predict adolescents' commitment to and experiences of an online ACT intervention. Also, a person-oriented approach was used to identify subgroups of adolescents based on their commitment to and experiences of the intervention. Second, Study II investigated how adherence and usage activity within the online ACT intervention were related to obtained gains in psychological well-being (i.e., increased life satisfaction and decreased stress). In addition, a person-oriented approach was used to assess patterns in program adherence, usage, and changes in well-being during the intervention. Lastly, Study III examined the extent to which levels of psychological well-being and changes in psychological well-being during last grade of basic education were associated with subsequent school engagement, and assessed the direct and indirect (i.e., through increased well-being) effects of the online ACT intervention to school engagement.

4.1 Individual and environmental antecedents of commitment to and intervention experiences of online ACT

Previous research has acknowledged that online psychological interventions are effective in adolescents, but less is known about who is likely to show higher commitment to or have positive experiences of the interventions. Addressing possible predictors may also help in considering how to make an online intervention program appealing to adolescents on a large scale. Study I assessed

how individual and environmental antecedents may predict adolescents' commitment to (i.e., usage activity) and experiences of (i.e., satisfaction and perceived usefulness) an online ACT intervention. The results showed that after controlling for the effects of all antecedents, especially gender and effortful control predicted commitment to and experiences of online ACT. Four subgroups were identified with a person-oriented approach: the Satisfied group (41% of participants; average usage activity and high satisfaction and perceived usefulness), the Dissatisfied group (18% of participants; low activity and very low satisfaction and perceived usefulness), the Active group (8% of participants; very high usage activity and average satisfaction and perceived usefulness), and the Moderate group (33% of participants; average usage activity, satisfaction, and perceived usefulness). Subgroup membership was found to be associated especially with gender, academic achievement, experienced closeness with mother and teacher, and experienced conflict with teacher.

Previously, findings regarding the association of gender and commitment to interventions have been mixed, but for studies that have found a connection between gender and adherence to online psychological interventions, the results point to a similar direction (e.g., Beatty & Binnion, 2016; Garrido et al., 2019). Essentially, the results of Study I showed that females were more committed to and reported more positive experiences of the online ACT. One possible explanation for this finding is that because the prevalence and experienced difficulty levels of mental health problems among young females is higher compared to young males (Van Droogenbroeck et al., 2018; Yoon et al., 2022), they may have higher motivation to use psychological interventions. Another possible explanation is that the content in the Youth Compass was more appealing and relatable to females than males (see also Garrido et al., 2019). This could also explain why there were significantly more males in the Dissatisfied group (80%) than in the other subgroups (percentage of males varied from 23% to 50%). Therefore, it may be that future attention also needs to be paid to the better incorporation of male adolescent interests into intervention program content. In line with previous research (Berg et al., 2014; Lillevoll et al., 2014), self-regulatory skills (measured in Study I by temperamental effortful control) and academic achievement were connected to intervention commitment and experiences.

The results showed that intervention commitment and experiences were, on the one hand, unrelated to levels of depressive symptoms and life satisfaction, but, on the other hand, connected to higher initial stress. Previous studies have found levels of depressive symptoms to predict adherence to online psychological interventions, albeit with mixed results: in some cases, more severe depressive symptoms have predicted adherence (e.g., Calear et al., 2013; Neil et al., 2009), and in others adherence was predicted by lower symptoms levels (e.g., Christensen et al., 2009). Study I differs from these by finding no association. Similarly, previous studies have suggested positive affect and happiness to predict adherence (Castro et al., 2021; Cuffee et al., 2012), but the results regarding baseline life satisfaction in Study I showed no association. The

contradictions between previous research and the results of Study I could possibly be explained by the fact that the Youth Compass is an intervention program that aims to increase well-being and skills related to maintaining well-being, whereas other studies have mostly investigated interventions that aim to decrease symptoms of mental health problems. Results regarding stress corresponded to those of Puolakanaho et al. (2019), according to whom adolescents with higher initial stress also obtained greater positive gains in their well-being from an online ACT intervention. The difference in stress between the Active and Dissatisfied subgroups seems to similarly highlight how adolescents with higher stress may be more likely to commit or stay motivated to use an online intervention. In sum, it seems that adolescents with varying levels of psychological well-being are as likely to be motivated to commit to the online ACT intervention program, but the likelihood is higher for those with higher experienced stress.

The results regarding interpersonal factors showed that especially positive relationships with adults and peers were associated with higher commitment and better intervention experiences, providing support for previous studies (Gulliver et al., 2010; Kyngäs, 2007). Teacher–student conflict was the only negative interpersonal factor that was connected to intervention commitment and experiences and subgroup membership. It seems possible that because pre- and post-measurements were conducted at school, school-related dynamics may have been more highlighted to the participants, and they may have oriented to the intervention as part of schoolwork. Parents' level of education was considered to reflect socioeconomic status (SES) in Study I. Despite previous studies showing SES to predict adherence (Hall et al., 2023; Shemesh et al., 2018), this was not supported by Study I. One explanation could be that majority of the participants' parents had an education of upper secondary level or higher (96.9% of mothers and 88.9% of fathers), which may limit SES-based comparisons. It could also be that due to rapid growth of technology and smartphone ownership also the differences in access to and usage of eHealth or mHealth has narrowed across sociodemographic groups (Vangeepuram et al., 2018).

Overall, Study I showed that online psychological intervention programs seem to respond better to female adolescent interests and are more likely to be actively used and found beneficial especially by adolescents with higher self-regulatory skills, higher academic achievement, higher experienced stress, and positive interpersonal relationships. The results of Study I shed light on who is more likely to commit to an online psychological intervention, but also revealed where future development could be targeted to make interventions more universally acceptable for adolescents. Future research needs to further explore how online psychological intervention programs may better fit individual interests, needs, and skills such as those related to self-regulation, attention, and comprehension. One solution here could be the use of tailoring, which may be used to, for example, regulate the amount of program content or personalize feedback to the user (Morrison et al., 2014; Neil et al., 2009).

4.2 Roles of adherence and usage activity in psychological well-being gains obtained during online ACT

Higher adherence is associated with better outcomes in online psychological interventions, but agreement on the definitions and indicators of adherence in an online context has yet to be reached (Donkin et al., 2011; Yardley et al., 2016). This dissertation followed a definition where adherence refers to the extent to which the user follows the intended usage of an intervention program (Donkin et al., 2011). Lately, research has turned towards investigating what constitutes effective engagement, that is, the extent of program usage that is sufficient to produce well-being changes (Michie et al., 2017; Pham et al., 2019). Essentially, instead of comparing the completion of an intervention program to non-completion, it may be more useful to examine how much program usage is enough to obtain positive gains in psychological well-being. This may be particularly beneficial for adolescents, who as a target population tend to express low adherence rates (Gearing et al., 2012). The aim of Study II was to examine how adherence (i.e., adherence percentage) and usage activity (i.e., completion percentage, usage time, and usage weeks) were related to gains in psychological well-being (i.e., life satisfaction and stress) during online ACT and to analyze individual patterns in adherence, usage activity, and changes in well-being.

Nearly half of the participants fully adhered to the Youth Compass program (i.e., showed adherence of 100% which was fulfilled by completing all recommended exercises). Regression analyses revealed that adherence to intervention predicted an increase in life satisfaction (but not changes in stress). Usage activity measures did not predict changes in life satisfaction or stress. Three subgroups of adolescents with different patterns of adherence, usage activity, and well-being gains were identified with the person-oriented approach: (1) Adhered, committed users with relatively large intervention gains (35% of participants; showed high adherence and usage activity rates and experienced an increase in life satisfaction and a decrease in stress), (2) Less committed users with no intervention gains (42% of participants; showed high adherence but used less time in the online ACT program, experienced no change in life satisfaction and an increase in stress), and (3) Non-committed users with no intervention gains (23% of participants; showed low adherence and usage activity rates and experienced no changes in life satisfaction or stress).

The results agreed with previous literature regarding the predictive role of adherence in outcomes of online psychological interventions (Hedman et al., 2013; Hilvert-Bruce et al., 2012; Manwaring et al., 2008; March et al., 2018). A previous study on an online ACT intervention similarly showed that adolescents who fulfilled the adherence criterion by completing at least half of the intervention experienced gains in their life satisfaction (Lappalainen et al., 2021b). However, it was unexpected that in Study II adherence predicted an increase in life satisfaction but not a decrease in stress. One explanation for this could be that different aspects of psychological well-being have different responses to

interventions. Different well-being outcomes could also be explained by possible underlying mechanisms of change, such as learning of mindfulness or other psychological flexibility skills (Bluth & Blanton, 2014). Another consideration is that the used measure for stress may not be sensitive enough to changes or that the outcomes were affected by subjective perspectives on the program's usefulness or relevance for one's life situation. Lastly, considering differences between the subgroups could also explain the results: Adhered, committed users with relatively large intervention gains and Less committed users with no intervention gains experienced different well-being outcomes despite having similar-looking patterns of adherence and usage activity. The two groups differed in terms of usage time, where the Adhered, committed users with relatively large intervention gains were found to have used more minutes in the intervention program compared to the Less committed users with no intervention gains. The result suggests that time investment is another important factor in terms of intervention outcomes.

In sum, positive gains in psychological well-being were more likely obtained by adolescents who used the online ACT intervention program as was recommended. Additionally, the difference between participants who obtained positive gains from the online ACT intervention and those who did not was shown in subgroup comparisons to associate with how much time adolescents used in the intervention program. In other words, positive well-being gains from a brief guided online ACT intervention are more likely when the users commit to use the program as intended and engage with the exercises by investing enough time in doing them. The results showed that examining adherence and usage activity in larger context than simply in terms of completion versus dropout offers a deeper insight into what may explain the well-being outcomes of online psychological interventions. Assessing possible facilitators of or barriers to intervention adherence or engagement would provide important additional information in why some users are more/less engaged with an online intervention. This could be done by adding subjective measures for recording users' perceptions of the program, alongside of objective data records (Michie et al., 2017). Further research is also needed to establish what constitutes effective engagement and what indicators of program usage accurately describe actual exposure to the intervention content (Michie et al., 2017; Yardley et al., 2016).

4.3 Psychological well-being and online ACT in relation to subsequent school engagement

Research regarding the association of adolescent mental health and school life supports the view that promoting psychological well-being also serves as part of supporting students' adjustment, academic success, and engagement with school and studies. Study III of this dissertation aimed to extend understanding of the relationship between well-being and school engagement by examining how

levels of psychological well-being and changes in psychological well-being during the final grade of basic education (i.e., ninth grade) were associated with subsequent school engagement. The possibilities of promoting students' school engagement and mental health with ACT-based interventions have previously been studied (Fang & Ding, 2020a; Grégoire et al., 2018). Less, however, is known whether this also applies to online ACT interventions. Study III concentrated on this gap by investigating direct and indirect effects (i.e., through increased well-being) of online ACT to school engagement.

The results of Study III indicated that a higher level of life satisfaction at the beginning of ninth grade (i.e., early fall) predicted higher school engagement in upper secondary education. In turn, an increase in depressive symptoms during the fall of ninth grade predicted lower subsequent school engagement. In addition, participation in an online ACT intervention during the ninth grade was shown to support later school satisfaction through decreased depressive symptoms. The results supported previous research literature on the association between higher psychological well-being and higher school engagement (Awang-Hashim et al., 2015; Heffner & Antaramian, 2016; Yuen, 2016), as well as between lower well-being and lower school engagement (Garvik et al., 2014; Parviainen et al., 2020; Sagatun et al., 2014). The mediation results on the effects of online ACT to school engagement via changes in depressive symptoms were concluded to support previous studies regarding the possibilities of ACT-based interventions in promoting student well-being and school engagement (Fang & Ding, 2020a; Grégoire et al., 2018).

In contrast, the results of Study III did not show changes in life satisfaction or the initial level of depressive symptoms to be associated with subsequent school engagement. One possible explanation for the result is that different aspects of well-being and well-being processes may have different connections with school engagement. Scales related to mood may also be more prone to short-term changes compared to global life satisfaction (Eid & Diener, 2004). It may also be that different dimensions of well-being have different relationships with school engagement. Because the school engagement measure in Study III reflected the emotional and behavioral but not the cognitive aspects of engagement (see also Fredricks, 2011; Fredricks et al., 2004), some associations may have been left undetected. The results of Study III also revealed that the effect of online ACT on school satisfaction was mediated by decreased depressive symptoms, but no effects were found through changes in life satisfaction or from online ACT to dropout intentions. It seems possible that different dimensions of well-being respond to online ACT interventions in different ways, which may, consequently, lead to varying results also in terms of indirect effects.

In sum, the results showed that levels of and changes in psychological well-being during the fall of ninth grade can to some extent predict school engagement after transition to upper secondary education. In addition, the results suggested that an online ACT intervention may increase psychological well-being, which can, in turn, support later school engagement. The results support the view that promoting adolescent mental health during basic education can make an

important contribution in efforts to support students' engagement in their studies and schools after the transition to upper secondary level.

4.4 Strengths, limitations, and future directions

The results of this dissertation largely supported previous research concerning the benefits of online psychological interventions with adolescents and the roles of adherence and usage activity in terms of intervention outcomes. New discoveries were made concerning individual differences in adherence and intervention outcomes, which extends our understanding of who is likely to commit to and benefit from online psychological intervention programs. Utilizing both variable- and person-oriented approaches in the original studies provided a deeper understanding on the differences between individuals and the extent to which it may be possible to predict adolescent commitment to, experiences of, and well-being gains from online ACT interventions.

There are some limitations that should be considered before attempting to generalize the results of this dissertation. First, as the investigated sample consisted of a non-clinical sample of Finnish adolescents, future research is encouraged to be conducted with also clinical samples and more diverse samples such as other age groups and ethnic groups. Another point regarding the sample was the binary coding used for gender in all studies of the present dissertation. In the present dissertation, gender and its coding in analyses was approached via gender assigned at birth, which includes a possibly inaccurate assumption of the sample being cisgender. Including more detailed information on the participants' gender identities in future studies could provide important information on also the possibly unique experiences of trans and gender diverse youth regarding online psychological intervention programs, well-being, and school life (American Psychological Association, 2015; Perry et al., 2018; Ren et al., 2022).

Second, information in the present dissertation concerning adolescents' reasons behind commitment or non-commitment was limited. Reasons that explain why some commit to an intervention program and some do not are likely to be diverse (e.g., time resources, technical issues, expectations or perceptions concerning online interventions; Achilles et al., 2020; Lillevoll et al., 2014). Therefore, investigating them in more detail would offer important insights into how intervention programs could be tailored to meet different interests and resources that individuals have. This includes considerations of how to avoid online interventions being non-engaging or even becoming a source of additional stress due to, for example, program content being too generic, demanding, or overwhelming (Morrison et al., 2014; Sweeney et al., 2019). Understanding adolescent experiences of the programs, such as their satisfaction and perceptions of program usefulness, as was investigated in Study I, is another important part of recognizing what may explain adherence.

Third, in the present dissertation, only two time points for assessing the participants' psychological well-being (i.e., before and after online ACT

intervention) and one time point for assessing subsequent school engagement were utilized. Using follow-up for psychological well-being factors would allow further inspection of longer-term trajectories in adolescent well-being. Regarding school engagement (which was assessed in Study III as satisfaction with school and dropout intentions), it would be beneficial to follow up on the actual outcomes regarding dropout. Intentions to drop out may not always lead to complete dropout from education; other possibilities are that students decide to continue their studies and graduate, or they drop out to switch schools and graduate from the new school. Taking these possibilities into account could add important information regarding dropout prevention and the interaction of psychological well-being and school engagement. Another point to consider is that the school engagement measures used in Study III reflected emotional and behavioral school engagement. Incorporating also cognitive aspects would provide more information on the dimensions of school engagement (Fredricks, 2011; Fredricks et al., 2004). This could be done by, for example, including indices regarding educational aspirations or goals (Lewis et al., 2011; Vasalampi et al., 2018).

Fourth, as a recommendation for future studies, other well-being instruments could be included to expand our understanding of applicability of online ACT with adolescents. Also, psychological flexibility processes could be further utilized when considering online ACT interventions for adolescent populations. Processes during interventions could be assessed by including ACT-based process measures such as, for example in case of adolescents, the Child and Adolescent Mindfulness Measure (CAMM; Greco et al., 2011). ACT-based processes were to some extent addressed in Study I of the present dissertation in terms of perceived usefulness, that is, participants' perceptions of their learning of mindfulness, acceptance, and values-related skills. ACT-based process measures could be used to assess intervention gains in more detail. In addition, process measures could be used to examine mediators of change in online ACT (Francis et al., 2016; Greco et al., 2011; Räsänen et al., 2020; Sairanen et al., 2020) and school engagement (Fang & Ding, 2023).

4.5 Practical implications

The high prevalence of mental health-related complaints among adolescents (Harrison et al., 2022; Ma et al., 2021), combined with the notion that adolescence is a common age of onset for long-term mental health problems (Kessler et al., 2005, 2007), calls for services that specifically target this age group. These services can include interventions that combine well-being promotion and mental health problem prevention. Online solutions for disseminating interventions are a cost-effective method to increase service availability and accessibility for adolescents. This dissertation investigated adolescents' usage activity, adherence, and well-being gains from an ACT-based online psychological intervention program. The obtained results may be applied in various ways to future research and practice.

The results of Study I contribute to understanding the characteristics of users who are more likely to commit to online psychological intervention programs. The results showed that female gender, higher self-regulatory skills, higher academic achievement, positive interpersonal relationships, and higher experienced stress before the intervention were connected to higher program usage activity and better perceptions of program usefulness in online ACT. Understanding factors that explain intervention commitment and experiences also help to identify who may need additional support in their motivation to commit to online interventions or are likely to benefit more from other forms of support. For example, future studies could be directed to further investigate what would motivate male adolescents to commit to online psychological interventions, as male participants in the present dissertation were found to be overrepresented in user subgroups with low usage activity and satisfaction rates. The reasons behind adolescent commitment or non-commitment to online psychological interventions are likely to be diverse, and diversity should be considered by growing the possibilities to tailor online psychological interventions to meet the interests, skills, and needs of individuals.

Study II of this dissertation found that positive gains from online ACT, shown as positive changes in psychological well-being, were more likely obtained by those individuals who used the program as it was intended by its design and engaged with the exercises by using more time in them. In other words, adherence and usage time were found to contribute to positive well-being changes during the online ACT intervention. In practice, this knowledge can be used in motivating adolescents to commit to online intervention programs. Previous studies seem to agree that adherence plays an important role in well-being outcomes of online psychological interventions, but lacks a clear definition for adherence and precise measures for it (Donkin et al., 2011; Hedman et al., 2013; Hilvert-Bruce et al., 2012). The results of Study II agree with what lately has been referred to as effective engagement, that is, investigating what constitutes a sufficient level of program usage that is enough to produce desired well-being outcomes. In the case of the Youth Compass program, following the program as was recommended (i.e., doing the six mandatory exercises per intervention week, 30 exercises in total for the whole program) and using the program for around 25 minutes per week was connected to positive well-being gains. Based on the results, adherence and usage activity are encouraged to be examined in a larger context that reaches beyond reporting program completion rates or numbers of dropouts. Doing this provides more detailed information that would also benefit future program design and organization.

Study III of this dissertation found that levels of and changes in life satisfaction and depressive symptoms were associated with later school engagement. This was found by examining well-being in the final year of basic education and school engagement one year later, after the transition to upper secondary education. In addition, it was discovered that decreased depression symptoms mediated the effect of online ACT on later school satisfaction. The results contribute to knowledge concerning the role of psychological well-being

in a school context and demonstrate that promoting adolescent well-being may have long-term implications on later school engagement and dropout prevention. A novel understanding was also obtained how an online ACT intervention program delivered during the final year of basic education may benefit adolescents by increasing well-being, and, consequently, support their later school engagement. Future studies are encouraged to continue examining associations of well-being and school engagement, as well as the possibilities of online ACT-based interventions in efforts to support mental health in a school context.

4.6 Conclusions

Providing accessible low-threshold services is at the forefront of supporting positive adolescent mental health and preventing development or advancement of mental health problems. Especially the time of the COVID-19 pandemic has highlighted the state of adolescent mental health and the need to provide more options for accessing services. The growth of access and use of technology has opened new ways of providing psychological information and interventions to large audiences. Online ACT-based interventions show great potential in their applicability to different age groups across various mental health-related issues. This dissertation examined adolescent (mean age 15) usage activity, adherence, and psychological well-being gains obtained from a brief guided online ACT-based intervention.

This dissertation indicated that female gender, higher self-regulatory skills, higher academic achievement, higher experienced stress before the intervention, and positive interpersonal relationships with surrounding adults were connected to adolescents' higher activity in the online ACT intervention and better ratings of satisfaction with the program and perceptions of the program's usefulness. Understanding factors that may predict online intervention commitment and experiences is useful in also recognizing who are likely to need additional support in order to commit to an online intervention or whether they are more likely to benefit from other types of well-being support. It was also discovered that higher gains in psychological well-being were predicted by the extent to which adolescents used the intervention program as was intended by its design, and that engagement and time investment were important in terms of positive well-being gains. This also indicates how adherence and usage activity should be addressed in a larger context than only completion or non-completion rates, which could be done by studying effective engagement in online interventions. Lastly, the results illustrated the connection of psychological well-being during the final year of basic education with subsequent school engagement, and that a brief guided online ACT intervention may increase well-being, which can, in turn, support later school engagement. Promoting adolescent well-being may, therefore, be an investment in favor of supporting later school engagement and preventing school dropout.

In sum, new discoveries were made concerning individual differences in adolescent adherence to online psychological intervention programs and related well-being outcomes. Recommendations for further research concerning online ACT for adolescents included conducting studies with more diverse samples and longitudinal designs that not only utilize objective usage activity measures, but also incorporate adolescents' subjective perceptions of program usage. This dissertation indicates that online ACT interventions that aim to increase psychological flexibility skills, such as the Youth Compass program, represent a viable option alongside other low-threshold services for adolescents. However, attention should also be paid to how to motivate different individuals to commit to and use enough time in the programs.

YHTEENVETO (SUMMARY)

Nuorten käyttöaktiivisuus, sitoutuminen ja hyvinvoinnillinen hyötyminen viisi viikkoa kestävästä hyväksymis- ja omistautumisterapiaan pohjautuvasta verkkointerventiosta

Nuoruus voidaan jakaa varhais-, keski- ja myöhäisnuoruuteen, jotka kattavat noin ikävuosien 11–25 välisen ajan (Curtis, 2015; Salmela-Aro, 2011). Tämä väitöskirja keskittyi keskinuoruutta eläviin, noin 15–16-vuotiaisiin yhdeksäsluokkalaisiin nuoriin. Keskinuoruudessa olennaista ovat muun muassa identiteetin rakentamiseen, sosiaalisten roolien muutokseen sekä aivojen, ajattelun ja itsesäätelyn kypsymiseen liittyvät kehitystehtävät (Kiuru, 2023; Salmela-Aro, 2011; Steinberg ym., 2018). Samaan aikaan nuoret tekevät keskeisiä valintoja liittyen tulevaisuuden opinto- ja urahaaveisiin. Nuoret myös päättävät peruskoulun yhdeksännen luokan jälkeen, jonka jälkeen he siirtyvät toisen asteen opintoihin.

Tutkimusten mukaan vähintään joka neljännellä nuorella esiintyy mielen hyvinvoinnin haasteita (Merikangas ym., 2010; Silva ym., 2020). Yksi keino vastata haasteisiin on tarjota nuorille interventioita, jotka tukevat hyvinvointia ja ennaltaehkäisevät pulmia tai niiden syvenemistä. Mindfulness- eli tietoisuustaitoihin pohjautuvien interventioiden on havaittu olevan hyödyllisiä tukemaan muun muassa nuorten hyvinvointia, itsesäätelyä, koulumenestystä ja keskittymisen taitoja (Phan ym., 2022). Hyväksymis- ja omistautumisterapia (HOT; Hayes ym., 1999) on eräs psykoterapeuttinen menetelmä, joka sisältää muun muassa arvoihin, hyväksyntään ja tietoisuustaitoihin liittyvien prosessien harjoittelua. HOT on alun perin kasvokkain toteutettava terapiamuoto, mutta sitä on onnistuneesti sovellettu myös verkkoympäristöihin (O'Connor ym., 2018; Thompson ym., 2021). HOT-pohjaisten verkkointerventioiden hyödyntämisestä nuorilla tiedetään kuitenkin vielä verrattain vähän.

Nuorten Kompassi on Jyväskylän yliopiston tutkijoiden kehittämä viiden viikon mittainen HOT-pohjainen verkkointerventio-ohjelma, jonka tavoitteena on tukea nuorten hyvinvointitaitoja. Interventio-ohjelma koostuu viidestä etapista, joista jokainen liittyy erilaiseen HOT-teemaan. Yksi etappi koostuu johdannosta sekä kolmesta tehtäviä sisältävästä tasosta. Jokaisella tasolla on suositellut tehtävät, eli "tähtitehtävät", joiden lisäksi käyttäjä voi halutessaan tehdä muita tarjolla olevia tehtäviä. Ohjelman tehtävät on suunniteltu kestämään muutamasta minuutista maksimissaan viiteen minuuttiin, ja suurin osa niistä ovat sekä kirjoitetussa että kuunneltavassa muodossa.

Tämän väitöskirjan otos koostui noin 250 nuoresta, jotka osallistuivat Nuorten Kompassi -interventiotutkimukseen. Nuoret satunnaistettiin yhteen kolmesta ryhmästä: interventioryhmään, johon kuului interventio-ohjelma sekä verkon kautta ja kasvokkain tapahtuva kontakti nimetyltä tukihenkilöltä (iACTface, n = 83), interventioryhmään, johon kuului interventio-ohjelma ja verkkokontakti tukihenkilöltä (iACT, n = 82), tai kontrolliryhmään, joka ei saanut interventiota (n = 84). Tukihenkilöt olivat psykologian kandidaatin tai maisterin tutkintoa suorittavia opiskelijoita (n = 31, 83% naisia), jotka olivat vastaanottaneet yhteensä 18

tuntia HOT-koulutusta ennen interventiota ja jotka saivat intervention aikana viikoittain ohjausta laillistetulta psykologilta. Verkkokontakti koostui tukihenkilöiden lähettämistä lyhyistä motivointi- ja kannustusviesteistä. Viestin ensimmäisessä osassa nuorta pyydettiin viikoittain arvioimaan omaa mielialaa asteikolla 4–10 (4 = erittäin huono; 10 = erittäin hyvä). Viestin toinen osa vaihtui viikon teeman mukaisesti (esim. etapilla 1: ”Mikä on sinulle tärkeää? Mitä voisit tehdä tänään tai huomenna lisätäksesi elämääsi iloa ja energiaa? Tee se!”). Interventio-ohjelma ja verkkokontakti olivat samat kaikille interventioon osallistuneille nuorille. Osa nuorista (iACTface-ryhmä) tapasivat tukihenkilöidensä kanssa ennen interventiota keskustellakseen nuoren elämäntilanteesta ja intervention jälkeen keskustellakseen nuoren interventiokokemuksista. Tässä väitöskirjassa iACTface ja iACT -ryhmät yhdistettiin yhdeksi interventioryhmäksi (n = 161), sillä interventiotuloksilla ei havaittu olevan merkitsevää yhteyttä siihen, kummassa ryhmässä osallistujat olivat (p > .05).

Tämä väitöskirja koostui kolmesta osatutkimuksesta. Osatutkimuksessa I tarkasteltiin, millaiset yksilöön ja ympäristöön liittyvät tekijät ennakoivat nuorten sitoutumista ja interventiokokemuksia Nuorten Kompassi -ohjelmassa. Osatutkimuksessa II tarkasteltiin Nuorten Kompassi -ohjelmaan sitoutumisen ja ohjelman käyttöaktiivisuuden rooleja suhteessa ohjelmasta saatuihin hyötyihin. Osatutkimuksessa III tarkasteltiin nuorten hyvinvoinnin yhteyksiä myöhempään koulutukseen sitoutumisen sekä missä määrin Nuorten Kompassi -ohjelmaan osallistuminen oli yhteydessä myöhempään koulutukseen sitoutumiseen hyvinvoinnin muutosten kautta.

Tiedot nuorten yksilöön (ml. psyykkinen hyvinvointi, eli stressi, elämään tyytyväisyys ja masennusoireet) ja ympäristöön liittyvistä tekijöistä kerättiin alkumittauksessa (T1) alkusyksyllä 2017. Alkumittauksen jälkeen toteutettiin Nuorten Kompassi -interventio, jonka aikana kerättiin lokitiedot nuorten ohjelman käyttöön sitoutumisesta ja käyttöaktiivisuudesta interventio-ohjelman sisällä. Loppusyksyllä 2017 (T2) nuorilta kerättiin heidän arviot interventiokokemuksista sekä uudelleen psyykkiseen hyvinvointiin liittyvät tiedot. Vuotta myöhemmin, toisen asteen koulutukseen siirtymisen jälkeen (T3), nuorilta kerättiin arviot tyytyväisyydestä nykyiseen koulutuspaikkaan ja aikomuksista keskeyttää opinnot nykyisessä koulutuspaikassa. Osatutkimukset I ja II tarkastelivat interventioryhmän nuoria alku- ja loppumittauksen välillä (T1 ja T2, n = 161). Osatutkimus III tarkasteli interventio- ja kontrolliryhmien nuoria kaikkien käytettyjen aikapisteiden välillä (T1, T2 ja T3, n = 243).

Osatutkimuksessa I tarkasteltiin, miten erilaiset yksilöön ja ympäristöön liittyvät tekijät ennakoivat nuorten käyttöaktiivisuutta (mittarina käyttöpäivät), tyytyväisyyttä ja koettuja hyötyjä HOT-verkkointerventiosta. Henkilökeskeisiä menetelmiä hyödyntäen tarkasteltiin, millaisia alaryhmiä nuorista muodostui perustuen ohjelman käyttöaktiivisuuteen, tyytyväisyyteen, ja koettuihin hyötyihin sekä millaisia yhteyksiä alaryhmillä oli yksilöön ja ympäristöön liittyviin tekijöihin. Aineistosta nousi esiin neljä alaryhmää: *Tyytyväisillä* (n = 65, 41%) käyttäjillä käyttöaktiivisuus oli keskitasolla ja tyytyväisyys ja koettu hyöty olivat korkealla tasolla. *Kohtuullisilla* (n = 51, 33%) käyttäjillä käyttöaktiivisuus,

tyytyväisyys ja koettu hyöty olivat kaikki keskitasolla. *Tyytymättömillä* (*n* = 29, 18%) käyttäjillä käyttöaktiivisuus oli matalalla ja tyytyväisyys ja koettu hyöty erittäin matalalla tasolla. *Aktiivisilla* (*n* = 12, 8%) käyttäjillä käyttöaktiivisuus oli erittäin korkealla ja tyytyväisyys ja koettu hyöty keskitasolla. Suurin osa (82%) nuorista olivat siis kohtalaisesta erittäin aktiivisia käyttämään ohjelmaa ja arvioivat tyytyväisyytensä ja koetun hyödyn kohtalaisesta erittäin korkealle. Tulokset osoittivat, että erityisesti tytöt ja nuoret, joilla oli korkea itsesäätely, vaikuttivat käyttävän ohjelmaa aktiivisemmin sekä olevan tyytyväisempiä ohjelmaan ja kokevansa sen hyödylliseksi. Lisäksi parempi koulumenestys ja positiiviset ihmissuhteet olivat yhteydessä korkeampaan sitoutumiseen ja interventiokokemuksiin. Vastaavasti korkeampi koettu konflikti opettajan kanssa oli yhteydessä matalampaan sitoutumiseen ja interventiokokemuksiin. Hyvinvoinniltaan eri tasolla olevat nuoret saattoivat yhtä todennäköisesti olla aktiivisia ja tyytyväisiä ohjelman käyttäjiä, mutta enemmän stressiä kokeneet nuoret todennäköisesti sitoutuivat vahvemmin ohjelmaan.

Osatutkimuksessa II tarkasteltiin, miten HOT-verkkointerventioon sitoutuminen (mittarina tehdyt tehtävät suhteessa suositeltuun määrään) ja ohjelman käyttöaktiivisuus (mittareina käyttöminuutit, käyttöviikot ja tehdyt tehtävät suhteessa koko ohjelman sisältöön) olivat yhteydessä ohjelmasta saatuihin hyötyihin (mittareina elämään tyytyväisyys ja stressi). Henkilökeskeisiä menetelmiä hyödyntäen tutkittiin, millaisia alaryhmiä muodostui perustuen osallistujien ohjelman käyttöön sitoutumiseen, käyttöaktiivisuuteen ja hyvinvoinnin muutoksiin. Tutkimuksessa havaittiin, että nuoret, joilla oli korkeampi stressitaso ennen interventiota, todennäköisemmin seurasivat ohjelman suositeltua käyttöä, käyttivät enemmän minuutteja ohjelmaan sekä käyttivät ohjelmaa useamman viikon ajan. Korkeampien käyttöviikkojen määrä oli myös yhteydessä korkeampaan stressitasoon intervention jälkeen. Tehtyjen tehtävien määrä sekä suhteessa suositeltuun määrään että suhteessa koko ohjelman sisältöön olivat yhteydessä intervention aikana kohonneeseen elämään tyytyväisyyteen. Alku- ja lopputason elämään tyytyväisyydellä tai stressin muutoksilla ei havaittu yhteyksiä ohjelmaan sitoutumiseen tai käyttöaktiivisuuteen. Tehtyjen tehtävien määrä suhteessa suositeltuun määrään havaittiin ennustavan elämään tyytyväisyyden kasvua (muttei stressin laskua) intervention aikana. Käyttöaktiivisuuden mittareiden ei havaittu ennustavan muutoksia hyvinvoinnissa.

Henkilökeskeisissä tuloksissa nuorista havaittiin muodostuvan kolme alaryhmää: (1) *Sitoutuneet ja suhteellisen paljon hyötyneet käyttäjät* (*n* = 52, 35%; piirteinä korkea sitoutuminen ja korkea käyttöaktiivisuus, kohonnut elämään tyytyväisyys, laskenut stressi), (2) *Vähemmän sitoutuneet ja hyötyjä kokemattomat käyttäjät* (*n* = 63, 42%; piirteinä korkea sitoutuminen, korkea määrä suoritettuja tehtäviä, vähemmän käyttöminuutteja, ei muutosta elämään tyytyväisyydessä, kohonnut stressi), ja (3) *Ei-sitoutuneet ja hyötyjä kokemattomat käyttäjät* (*n* = 35, 23%; piirteinä matala sitoutuminen ja matala käyttöaktiivisuus, ei muutoksia elämään tyytyväisyydessä tai stressissä). Ryhmien vertailussa havaittiin, että Sitoutuneet ja suhteellisen paljon hyötyneet käyttäjät kokivat elämään tyytyväisyyden kasvua, kun taasen toiset ryhmät eivät kokeneet muutoksia. Stressin muutoksissa oli

merkitseviä eroja kaikkien ryhmien välillä: Sitoutuneet ja suhteellisen paljon hyötyneet käyttäjät kokivat stressin laskua, Vähemmän sitoutuneet ja hyötyjä kokemattomat käyttäjät kokivat stressin kasvua, ja Ei-sitoutuneet ja hyötyjä kokemattomat käyttäjät eivät kokeneet stressin muutoksia. Lisävertailuissa haluttiin selvittää, mikä voisi selittää hyvinvoinnin muutoksiin liittyviä tuloksia Sitoutuneiden ja suhteellisen paljon hyötyneiden käyttäjien ja Vähemmän sitoutuneiden ja hyötyjä kokemattomien käyttäjien välillä. Käyttöminuuteissa havaittiin tilastollisesti merkitsevä ero: ensimmäisellä ryhmällä käyttö oli noin 24–25 minuuttia viikossa ja jälkimmäisellä noin 18 minuuttia viikossa. Näin ollen katsottiin, että ohjelman suositellun käytön seuraamisen lisäksi riittävä ajankäyttö tehtävien tekemiseen on tärkeässä osassa HOT-verkkointervention lopputulosten suhteen.

Osatutkimuksessa III tarkasteltiin yhteyksiä nuorten hyvinvoinnin (mittareina elämään tyytyväisyys ja masennusoireet), koulutukseen sitoutumisen (mittareina tyytyväisyys koulutuspaikkaan ja aikeet keskeyttää opinnot nykyisessä oppilaitoksessa) ja HOT-verkkointervention välillä. Tutkimus toteutettiin ensin tarkastelemalla 9.-luokan aikaisen hyvinvoinnin tason (alkusyksy) ja muutoksien (alkusyksystä loppusyksyyn) yhteyksiä myöhempään sitoutumiseen toisen asteen koulutukseen. Toiseksi tarkasteltiin HOT-verkkointervention suoria ja epäsuoria yhteyksiä hyvinvointiin ja hyvinvoinnin kautta toisen asteen koulutukseen sitoutumiseen. Tulokset osoittivat, että korkeampi elämään tyytyväisyyden taso 9. luokan alkusyksyllä ennakoi korkeampaa tyytyväisyyttä toisen asteen koulutuspaikkaan ja matalampia aikomuksia keskeyttää opinnot. Masennusoireissa tapahtuva kasvu 9. luokan alkusyksystä loppusyksyyn ennakoi matalampaa tyytyväisyyttä toisen asteen koulutuspaikkaan ja korkeampia aikomuksia keskeyttää opinnot. Vuorostaan 9. luokan alkusyksyn taso masennusoireissa tai alkusyksystä loppusyksyyn tapahtuvat muutokset elämään tyytyväisyydessä eivät ennakoineet myöhempää toisen asteen koulutukseen sitoutumista. Analyyseissa havaittiin yksi merkitsevä yhteys HOT-verkkointerventiosta masennusoireiden laskuun, ja tätä kautta korkeampaan myöhempään tyytyväisyyteen toisen asteen koulutuspaikkaa kohtaan (keskeytysaikeisiin ei havaittu merkitsevää yhteyttä). Vaikutuksia elämään tyytyväisyyden kautta myöhempään koulutukseen sitoutumiseen ei havaittu. Tutkimuksen tulokset osoittivat, että peruskoulun päätösvaiheessa olevien nuorten hyvinvoinnin taso ja muutokset hyvinvoinnissa olivat yhteydessä heidän myöhempään sitoutumiseensa toisen asteen koulutukseen. Lisäksi tulokset osoittivat, miten HOT-verkkointerventio-ohjelman avulla voidaan lievittää nuorten masennusoireita, mikä puolestaan voi tukea myöhempää tyytyväisyyttä toisen asteen koulutuspaikkaan.

Väitöskirjan tulokset tuottivat tärkeää tietoa, jota voidaan soveltaa tutkimuksessa ja käytännössä. Tulokset tukivat aikaisempia tutkimustuloksia verkkointerventio-ohjelmien hyödyllisyydestä nuorten hyvinvoinnin tukemisessa sekä siitä, että ohjelmien käyttöön sitoutuminen ja käyttöaktiivisuus ovat tärkeässä asemassa interventiohyötyjen suhteen. Väitöskirjan tutkimukset tuottivat uutta tietoa yksilöiden välisistä eroista ohjelmiin sitoutumisessa ja intervention lopputuloksista, mikä lisää tietoutta siitä, millaiset käyttäjät ja millainen käyttö voi ennakoida haluttuja hyvinvoinnillisia hyötyjä. Väitöskirjan tutkimusten

vahvuuksiin voidaan lukea sekä muuttuja- että henkilökeskeisten menetelmien hyödyntäminen. Näin saatiin tuotettua tarkempaa tietoa siitä, miten on mahdollista ennakoida HOT-verkkointerventioiden käyttöön sitoutumista ja interventiokokemuksia ja miten käyttäjät eroavat toisistaan yksilötasolla. Tutkimalla näitä asioita voidaan myös paremmin tunnistaa, millaiset nuoret voisivat hyötyä esimerkiksi lisätuesta motivaation ylläpitämiseksi tai missä nuoret mahdollisesti tarvitsevat kannustusta jatkaakseen ohjelman parissa. Uusia löydöksiä tehtiin myös sen suhteen, miten peruskoulun lopulla toteutettu HOT-verkkointerventio voi hyödyttää nuoria ja miten vaikutukset voivat myönteisten hyvinvoinnin muutosten kautta näkyä myös myöhemmässä koulutukseen sitoutumisessa. Tulevaisuuden tutkimuksissa voisikin jatkaa HOT-verkkointerventioiden vaikutusten tarkastelua nuorten hyvinvointiin kouluympäristössä.

Ennaltaehkäisevällä työllä pyritään puuttumaan hyvinvoinnin haasteiden syntyyn, monimuotoistumiseen tai syvenemiseen. Nuorille on äärimmäisen tärkeää pystytä tarjoamaan matalalla kynnyksellä saavutettavissa olevia mielenterveyttä tukevia palveluita. Näille palveluille tärkeitä piirteitä ovat samaistuttavuus, kiinnostavuus ja helppo saavutettavuus, mitkä tukevat nuorten autonomiaa, vähentävät mielenterveyden haasteisiin liittyviä ennakkoluuloja, sekä kasvattavat nuorten kykyjä tunnistaa mielenterveyden haasteiden merkkejä ja milloin ammattiapu on tarpeen (Gulliver ym., 2010; Radez ym., 2021). Nuorten hyvinvoinnin ja psykologisen joustavuuden taitojen tukemiseen tarkoitetut HOT-pohjaiset verkkointerventio-ohjelmat, kuten Nuorten Kompassi, ovat lupaava vaihtoehto interventioksi osana mielenterveyttä tukevaa ja mielenterveyden pulmia ennaltaehkäisevää työtä. Jatkossa tärkeää on kuitenkin huomioida, miten nuorten motivaatiota voidaan ylläpitää ohjelmiin sitoutumiseksi ja miten kannustaa käyttämään tarpeeksi aikaa ohjelmiin haluttujen vaikutusten saamiseksi.

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ORIGINAL PAPERS

I

USAGE ACTIVITY, PERCEIVED USEFULNESS, AND SATISFACTION IN A WEB-BASED ACCEPTANCE AND COMMITMENT THERAPY PROGRAM AMONG FINNISH NINTH-GRADE ADOLESCENTS

by

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Usage activity, perceived usefulness, and satisfaction in a web-based acceptance and commitment therapy program among Finnish ninth-grade adolescents

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ABSTRACT

Understanding adolescent usage activity and experiences in web-based psychological intervention programs helps in developing universal programs that can be adopted for promotion of adolescent well-being and prevention of mental health problems. This study examined the usage activity, perceived usefulness (i.e., learning of mindfulness, acceptance and value-related skills), and program satisfaction of 157 Finnish ninth-grade adolescents, who participated in a school-based five-week universal acceptance and commitment therapy web intervention called Youth Compass. Individual and growth environment-related antecedents were measured before the five-week intervention, adolescents' usage activity during the intervention, and perceived usefulness and satisfaction after the intervention. The results showed that female adolescents and adolescents with high self-regulation were more active program users and had more positive experiences of the program. Most of the adolescents used the program on at least a moderate level and perceived it to be moderately or highly useful and satisfactory. Four subgroups of adolescents were identified based on their usage activity, perceived usefulness, and satisfaction: adolescents in the satisfied group (41%) had average activity and high perceived usefulness and intervention satisfaction, the dissatisfied group (18%) had low activity and very low perceived usefulness and intervention satisfaction, the active group (8%) had very high activity and average perceived usefulness and intervention satisfaction, and the moderate group (33%) had average activity, perceived usefulness and intervention satisfaction. Gender, academic achievement, closeness to mother and teacher, and conflict with teacher were significantly related to subgroup membership. The results suggested that adolescent usage activity, perceived usefulness, and satisfaction with the Youth Compass program may to some extent be predicted based on different factors.

1. Introduction

Adolescence begins in puberty and is usually defined to last from around age 12 to 22 (Aalto-Setälä, 2010; Csikszentmihalyi, 2019). It is a rapid developmental phase characterized by a variety of changes such as physical growth, sexual maturation, building autonomy, structural changes in social relations, and adopting new areas of responsibility (Aalto-Setälä, 2010; Lehtonen, 2010). Half of adult mental health problems have their onset before or during adolescence, and disorders related to depression, anxiety, behavior, and substance use represent the most common ones among adolescents (WHO, 2018). The prevalence of mental disorders reach their peak in early adulthood, and it has been estimated that around one in five young people show symptoms that are on a disorder level (Aalto-Setälä, 2010; Marttunen and Kaltiala-Heino, 2007). Therefore, the prevention of mental disorders is a public health priority, and a substantial base of evidence states that effective prevention can strengthen protecting factors and reduce risk factors relating to mental health (WHO, 2004). Early intervention may have long-lasting benefits and prevent the onset and further development of mental health problems. School-based universal preventive intervention programs, i.e., programs delivered to all students instead of selected group, are optimal in wide reach of young people and schools play an important

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role in adolescent mental health promotion (Mackenzie and Williams, 2018; O'Connor et al., 2018).

Web-based psychological intervention programs have been a growing interest in research due to their accessibility, cost-effectively achievable benefits, and reduced stigma, and have been suggested to be as effective as other treatment formats (Andersson, 2018; Spence et al., 2011; Sweeney et al., 2019). Web-based psychological intervention programs that include guidance, which can be supportive and practical instead of deliberately therapeutic, have been found to have better outcomes compared to treatments with no guidance (Andersson and Cuijpers, 2009; Andersson and Titov, 2014; Richards and Richardson, 2012). A clinician may be involved in web-based psychological intervention programs in various ways and with varying levels of contribution, but it has also been noted that efficient support may come from a sufficiently trained non-clinician (e.g., Lappalainen et al., 2007; Räsänen et al., 2016). Researching the potential in web-based psychological intervention programs may reveal important information on how to reach groups that might have previously been overlooked.

Adherence, compliance, and retention have been an area of interest in medical literature (e.g., see Borus and Laffel, 2010; Dodds et al., 2003; Kyngäs and Rissanen, 2001), and though not completely unknown in other fields, the exact measurements and mechanisms of adherence in the context of web-based psychological intervention programs have yet to be identified (Donkin et al., 2011; Short et al., 2018; Sieverink et al., 2017). Adherence to web-based psychological intervention program was in the present study represented by the frequency of activity shown within the intervention program (Neil et al., 2009; Perski et al., 2017; Ryan et al., 2018). Investigating factors associated with engaging in web-based psychological intervention programs may provide information on how to increase participants' completion of the program, thus increasing the probability of gaining as much as possible from the program.

1.1. ACT-based interventions among adolescents

Acceptance and commitment therapy (ACT) is a third-wave cognitive behavioral therapy that is based on functional contextualism and sees psychological events as a set of interactions between whole organisms and different contexts (Hayes et al., 1999). ACT endeavors to identify language processes that produce ineffective strategies of control (Hayes, 2004; Hayes et al., 1999). The aim in ACT is to increase psychological flexibility, which is divided into six key processes: values, committed action, acceptance, contact with the present moment, cognitive defusion, and self as context (Hayes et al., 2006). Different metaphors, exercises, and homework are used to recognize the connection between thoughts, emotions, and behavior.

Research concerning adult populations is relatively more common in ACT-based interventions than among adolescent populations (e.g., see Halliburton and Cooper, 2015; Powers et al., 2009; Ruiz, 2012). Research among adolescents has, however, been conducted on various topics such as depressive symptoms (Ames et al., 2013; Hayes et al., 2011; Lappalainen et al., 2021), ADHD (Zylowska et al., 2008), stress (Livheim et al., 2014; Puolakanaho et al., 2019b), anorexia (Heffner et al., 2002) and anxiety (Biegel et al., 2009). Findings among adult as well as adolescent populations have suggested ACT-based interventions to be effective for a range of mental and physical health problems and for supporting psychological well-being.

A psychological intervention program designed for adolescent populations should account for the individual differences in biological, psychological and social domains to make the program developmentally appropriate. Individual differences have been addressed in ACT-based programs by providing multiple brief, experiential and interactive exercises and by utilizing demonstrative examples, drawing, role-playing, games, writing, art, and other concrete tools (Hayes and Ciarrochi, 2015). These support adolescents to become aware of their inner and outer experiences, to accept them and to detached from them (Hayes et al., 2010; Kingery et al., 2006). Furthermore, motivation for treatment can be strengthened by using an adolescent's own fields of interest in seeking for values and actions based on them. (Halliburton and Cooper, 2015; Kingery et al., 2006; Puolakanaho et al., 2019a; Wicksell et al., 2009). Insights and skills obtained during the intervention are important to transmit from the intervention to the adolescent's everyday life and social relationships, in which friends and peer support can offer an applicable platform for rehearsal (Kingery et al., 2006; Livheim et al., 2014; Puolakanaho et al., 2019b).

1.2. Factors anticipating adolescents' engagement with and experiences of web-based ACT interventions

Adherence to treatment by adolescents has been found to be connected to factors such as self-regulation skills (Berg et al., 2014; Graziano et al., 2011; Miller et al., 2020) and the perceived threat of physical disease affecting mental well-being (Kyngäs, 2007). Demographic variables such as age, gender, and parents' educational level have received mixed results, with some studies finding connections to adherence and some not (see, e.g., Calear et al., 2013, Christensen et al., 2009, Garrido et al., 2019, Kristensen et al., 2018, Marko-Holguin et al., 2010, Mattila et al., 2016, Neil et al., 2009, Williams et al., 2006). Higher average school grades have been associated with greater uptake intentions for web-based psychological interventions (Lillevoll et al., 2014). Regarding adolescents' well-being, pre-intervention depression symptom severity has also received mixed results between studies as some have reported higher adherence to associate with higher depression symptom severity but others have reported the associations to occur with lower depression symptom severity (Batterham et al., 2008; Calear et al., 2013; Christensen et al., 2009; Korbel et al., 2007; Kristensen et al., 2018; Neil et al., 2009; Nock and Ferriter, 2005).

Support and encouragement from others have also been identified to play a role in adolescents' help-seeking process and treatment adherence (Gulliver et al., 2010; Kyngäs and Rissanen, 2001; Kyngäs, 2007). Adolescence is a developmentally sensitive period, and the effects of acceptance and rejection in relationships with parents, teachers, and peers during this period hold risks and buffers that contribute to later social and emotional adjustment (Fredriksen and Rhodes, 2004; Kiuru et al., 2019; Parker and Asher, 1987; Sentse et al., 2010; Videon, 2005; Wanders et al., 2020). Due to the involvement of interpersonal relationships in adjustment, behavior, and adherence, there is a possibility that they could also contribute to predicting adolescent usage and the experiences gained from a psychological intervention program.

Adolescent perceptions and attitudes towards web-based psychological intervention programs seem to be generally positive (Sweeney et al., 2019; Van Voorhees et al., 2009; Whittaker et al., 2012). Greater perceived benefits of web-based interventions have been associated with greater liking for technology and more positive attitudes towards mental health, whereas these factors, along with being of female gender, having no prior experience with web-based psychological interventions, and having greater knowledge of them were associated with higher perceived helpfulness (Sweeney et al., 2019). Therapy programs with more surface credibility, that is, looking and feeling competent, have been suggested to result in higher engagement and satisfaction with the program (Wozney et al., 2017). Users are more likely to be motivated to use the program when it presents the concepts in an engaging way, allows interaction, and is relatable and easy to navigate (Wozney et al., 2017). ACT intervention programs in web-based forms (Lappalainen et al., 2015; Lappalainen et al., 2007; Puolakanaho et al., 2019b) and as a web-based adjunctive tool (Levin et al., 2015) have received positive feedback, with participants largely satisfied with the intervention and found it useful in regards to learning mindfulness, acceptance and value-related skills, whose promotion is the central aim in ACT interventions.

Based on previous findings stemming mainly from face-to-face ACT interventions, gender, academic achievement, self-regulation (in terms of effortful control), and psychological well-being (using measurements

of pre-intervention stress level, life satisfaction, and depressive symptoms) were selected among the possible antecedents of usage and experiences of a web-based psychological intervention program in the current study. In addition to examining these biological and psychological domains, the individual differences in the social domain were also examined: environmental antecedents of usage and experiences of a web-based ACT program included parents' educational level, peer acceptance, peer rejection, and perceived closeness to and conflict with parents and teachers.

1.3. Current study

We examined Finnish adolescents' usage activity and experiences of a brief universal ACT-based web intervention program called Youth Compass. Previously, studies on Youth Compass have shown adolescents to experience positive gains in their psychological well-being (Lappalainen et al., 2021; Puolakanaho et al., 2019b). The current study investigated how individual and environmental antecedents predict adolescents' usage activity and user experiences in the Youth Compass program. Making behavioral changes tends to require frequent practice and ongoing effort to consolidate and integrate them into everyday life. Thus, we determined *usage activity* of the intervention as an indicator of frequent practice. Usage activity refers in the present study to the frequency of accessing the web-based intervention, operationalized as the number of separate days a participant used the intervention program during the five-week intervention period (see also Perski et al., 2017; Ryan et al., 2018). In addition, we were interested in participants' intervention experiences, that is, their perceptions of satisfaction with and the usefulness (i.e., learning of mindfulness, acceptance and value-related skills) of the intervention program. Adolescent intervention experiences and their perceptions of learning well-being skills may reveal valuable information on what could make a program more appealing to adolescents, thus encouraging them to use it more and benefit from it as much as possible.

The more detailed research questions were the following:

1) To what extent are individual (i.e., gender, effortful control, academic achievement, and psychological well-being) and environmental (i.e., parents' level of education and relationships with peers, parents, and teachers) antecedents associated with adolescents' usage activity and their experiences of the web-based Youth Compass intervention program?
2) What subgroups of adolescents can be identified based on their usage activity and experiences (i.e., perceived usefulness and intervention satisfaction) of the web-based Youth Compass intervention program?
3) To what extent are individual and environmental antecedents associated with subgroup membership in regard to adolescents' usage activity and experiences of the web-based Youth Compass intervention program?

2. Method

2.1. Participants and procedure

Sample selection and randomization to intervention groups was done in two phases. First, a subsample from the community sample of a broader longitudinal project (about 800 participants) was randomized to partake in the universal Youth Compass intervention at fall of 2017, at the beginning of Grade 9. The intervention targeted the whole population of students, i.e. participants were not identified as having mental health problems. All participants and their parents had given written consent to participate in the intervention prior to randomization. Second, the subsample was randomized into two intervention groups: group with online support in addition to face-to-face support (n = 83) and group with only online support (n = 82). Two participants from each randomized group did not participate in pre-measurement condition at Grade 9 early fall (n = 81 and n = 80 respectively). In turn, four participants from group of online support in addition to face-to-face support did not take part in post-measurement at Grade 9 late fall (n = 77 and n = 80 respectively).

Participant characteristics are presented in Table 1. Pre- and post-measurements were carried out during school hours and the adolescents used the intervention program on their leisure time. Each participant was given a personal coach who provided online support and reminders about the program in the form of instant text messages via the WhatsApp application. The coaches were bachelor or master's level psychology students who were trained in the acceptance and commitment therapy approach prior to the intervention. In the present investigation all the adolescents randomized in the Youth Compass intervention (n = 161) were analyzed as one group. Because the type of support (only online support or online support in addition to minimal face-to-face support) did not contribute in a statistically significant way to adolescents' usage activity, perceived usefulness and satisfaction with the intervention program ($p > .05$ in all), the type of intervention group was not included in the subsequent analyses of this study.

During the five-week Youth Compass intervention, each week presented a different module focusing on a specific ACT-based theme: (1) finding personal interests, (2) awareness of self, skills of acceptance and cognitive defusion, (3) being in the present, (4) self as context and self-compassion, and (5) applying important actions to social life and compassion towards others. A single module consisted of an introduction and three different levels in which at least two exercises were to be completed to advance in the program. The participant needed to complete at least six separate exercises that were approximately five minutes long in order to finish the module. For further details about the intervention program, see Puolakanaho et al. (2019b) and Lappalainen et al. (2021).

Individual and environmental antecedents were measured in the pre-measurement carried out before the intervention, in the early fall of Grade 9. Adolescents' activity in using the intervention program was measured during the intervention, and adolescents' experiences of the intervention were measured in the post-measurement carried out after the intervention, in the late fall of Grade 9.

Table 1
Demographic information on Youth Compass intervention participants (n = 161).

Characteristic	All Youth Compass participants
Age: *M* (*SD*)	15.26 (0.32)
Gender: Female, *n* (%)	81 (50)
Mother tongue	
Finnish *n* (%)	151 (94)
Other than Finnish *n* (%)	6 (4)
Bilingual *n* (%)	3 (2)
Lives with	
Mother and father *n* (%)	111 (71)
With mother or father *n* (%)	16 (10)
Alternately with mother and father *n* (%)	23 (15)
Other[a] *n* (%)	7 (4)
Mother's education level[b] *M* (*SD*)	4.32 (1.33)
Father's education level[b] *M* (*SD*)	3.87 (1.50)

Note. *M* = mean, *SD* = standard deviation.
[a] Participant lives with mother and stepfather, father and stepmother, in foster care, or in approved home.
[b] Education level on scale of 1 to 7, where 1 = no vocational training; 7 = postgraduate degree, i.e., licentiate, doctorate.

2.2. Outcome measures

2.2.1. Intervention-related usage activity and experiences of the intervention (Grade 9, late fall, after the five-week Youth Compass intervention)

Usage activity of the web-based intervention program

Adolescents' usage activity was measured by the number of separate days a participant used the intervention program. In other words, higher number of separate usage days during the five-week intervention period was considered to represent higher usage activity.

Satisfaction with the intervention program

Adolescents were asked to evaluate two questions on a scale from 4 to 10 (4 = very unsatisfied; 10 = very satisfied) how satisfied were they with the Youth Compass experience generally and how satisfied were they with the Youth Compass program. Mean scores were calculated to measure the level of satisfaction with the intervention program (α = .95).

Perceived usefulness of the intervention program

Adolescents reported their perceived usefulness of the intervention program in regards to learning mindfulness, acceptance and value-related skills, the promotion of which is in the heart of ACT interventions (Flaxman et al., 2013; Hayes et al., 1999; Twohig et al., 2010). Adolescents answered to seven statements on a scale from 4 to 10 (4 = I haven't learned at all; 10 = I have learned very much) relating to skills learned with the help of the program. These included, for example, "I have learned to notice my thoughts, emotions, and feelings better"; "I have learned to distance myself from thoughts and emotions." Mean scores across these ratings were calculated to measure how useful the intervention program was perceived to be (α = .96).

2.2.2. Individual-related antecedents (Grade 9, early fall, before the Youth Compass intervention)

Gender

Adolescents' gender was coded as 0 = female and 1 = male.

Temperamental effortful control

Temperamental effortful control refers to the capacity in stimuli response and attentional regulation (Eisenberg, 2012; Rothbart and Jones, 1998; Rothbart, 2011), and is used in this study as a measure for self-regulation. Using the short version of the revised Early Adolescent Temperament Questionnaire (EATQ–R; Capaldi and Rothbart, 1992, Ellis and Rothbart, 2001, Ellis, 2002, short self-report version translated to Finnish by Katri Räikkönen-Talvitie and the Developmental Psychology Research Group of University of Helsinki), the adolescents assessed their temperament and self-regulation on a scale from 1 to 5 (1 = almost never true; 5 = almost always true). The subscale for temperamental effortful control consists of seven statements, such as "It is easy for me to really concentrate on homework problems"; "I have a hard time finishing things on time" (reversed). A mean score for individual adolescents' effortful control (α = .80) was calculated. Higher temperamental effortful control is indicated by a higher mean score.

Academic achievement

Adolescents provided information on their overall academic achievement as a self-evaluated grade point average. The grade range in the Finnish school system is from 4 to 10, where 5 is the lowest and 10 the highest accepted grade. Self-reported school grades have been shown to have a correlation of .86 with the actual grades from school registers (Sainio et al., 2019).

Stress

After explaining stress in written form ("Stress refers to a situation where people feel tensed, restless, nervous, or anxious and have difficulties sleeping due to the things wandering in their mind"), the participants answered the question "Do you feel this kind of stress at the moment?" using a six-point scale (1 = not at all; 6 = very much). The single-item measure for stress covers psychological symptoms and sleep disturbances, which are central indicators of stress (Elo et al., 2003). According to Elo et al. (2003), the validity of the single-item measure for stress is supported by its congruence with other validated measurements for mental well-being like the General Health Questionnaire (GHQ) and 36-Item Short Form Survey (SF–36).

Depressive symptoms

Adolescents were asked to assess their mood during the last month by completing the Depression Scale (DEPS; Salokangas et al., 1995, see also Kiuru et al., 2012, Poutanen et al., 2010). The questionnaire consists of 10 items (e.g., "I feel sad"; "I feel that my future is hopeless"), which are answered on a scale from 0 to 3 (0 = not at all; 3 = very much), making the range of the sum score 0–30 (α = .95). A higher score refers to a greater severity of depressive symptoms. A score of 9–10 is considered as the cut-off for some depressive symptoms and a score of 11–12 as the clinical cut-off (Poutanen et al., 2010).

Life satisfaction

To measure adolescents' life satisfaction, the Finnish version of the Satisfaction with Life Scale (SWLS; Diener et al., 1985, see also Mauno et al., 2018) was used. The scale consists of five items (e.g., "I am satisfied with my life"; "So far I have gotten the important things I want in life") which are answered on a scale of 1 to 5 (1 = completely disagree; 5 = completely agree). Mean scores were then calculated from the items, so the range of the life satisfaction scale was between 1 and 5 (α = .92), where a higher score indicated higher life satisfaction.

2.2.3. Environment-related antecedents (Grade 9, early fall, before the Youth Compass intervention), that is, the level of parental education and quality of relationships with peers, parents, and teachers were measured in the fall of Grade 9 before the Youth Compass intervention

Level of parents' education

Adolescents' parents reported their level of education with a corresponding value of 1 to 7 (1 = no vocational training; 7 = postgraduate degree, i.e., licentiate, doctorate).

Peer acceptance and peer rejection

Adolescents' peer acceptance and peer rejection in Grade 9 was measured using a sociometric nomination procedure. Adolescents nominated up to six peers in the same grade but outside of their own class with whom they most like to spend time (positive nominations) and up to six peers in the same grade but outside of their own class with whom they least like to spend time (negative nominations) during schooldays. Peer acceptance represents the number of positive nominations each adolescent received, standardized within grade level, whereas peer rejection represents the number of negative nominations each adolescent received, standardized within grade level. Sociometric nominations provide valid, stable, and reliable assessments of peer acceptance during childhood and adolescence (Bukowski et al., 2012).

Closeness to and conflict with parents

To measure the adolescents' relationship with their parents, they rated their experiences using the Child–Parent Relationship Scale (CPRS; Driscoll and Pianta, 2011, see also Mauno et al., 2018). The questionnaire measures experienced closeness with five items (e.g., "I have a close and warm relationship with my mother/father") and conflict with six items (e.g., "I often argue with my mother/father"), which are answered on a scale from 1 to 5 (1 = not true at all; 5 = completely true). Mean scores were calculated to measure the adolescents' perceived closeness to and conflict with their mothers (α = .89, α = .87 respectively) and fathers (α = .90, α = .87 respectively).

Closeness to and conflict with teachers

To measure the adolescents' relationship with their teacher they rated their experiences using the Student–Teacher Relationship Scale (STRS–Short Form; Pianta, 2001). On a scale from 1 to 5 (1 = not true at all; 5 = completely true), adolescents answered five items regarding closeness (e.g., "I have a close and warm relationship with my teacher") and six items regarding conflict (e.g., "I often argue with my teacher"). The mean scores were calculated across these ratings to estimate the adolescents' perceptions of their closeness (α = .77) and conflict (α = .88) with their teacher.

2.3. Analysis strategy

The first aim of the current study was to examine the extent to which adolescent- and environment-related factors are related to adolescents' usage activity and experiences of the Youth Compass intervention program. This research question was answered with variable-oriented analysis methods, that is, correlations and regression analyses. Further aims of the study were to identify subgroups of adolescents based on their usage activity and experiences with Youth Compass and explore associations of individual and environment-related factors for membership in these subgroups. These research questions were answered by person-oriented analysis methods using latent profile analysis (i.e., LPA, mixture modelling, Muthén and Asparouhov, 2006, Vermunt and Magidson, 2002). The analysis seeks to identify the smallest number of latent groups that adequately describe the mean profiles of observed continuous variables as well as to enable investigation of the correlates of these subgroups. All of the variables (i.e., usage activity, intervention satisfaction and perceived usefulness of intervention) were standardized before the LPA analyses.

The latent profile analyses were conducted using Mplus (version 8.4, Muthén and Muthén, 1998–2017). The following indices were used to select the number of latent groups from the latent profile analyses: (a) the fit of the model, (b) the average latent class probabilities and the number of adolescents to be located in a latent group, and (c) the practical usefulness, theoretical justification, and interpretability of the latent group solution (Bauer and Curran, 2003; Muthén, 2003). The fit of the model was evaluated by the following criteria: (a) the Bayesian information criterion (BIC), (b) the Lo–Mendell–Rubin adjusted likelihood ratio test (aLRT), (c) the Vuong–Lo–Mendell–Rubin likelihood ratio test (VLMR), and (d) Bootstrap Likelihood Ratio Test (BLRT; McLachlan and Peel, 2000). Lower values of information criteria indicate a better model, and significant aLRT and VLMR test results indicate a higher number of groups. Finally, comparison between latent groups in regard to individual and environment-related antecedents was conducted using the Mplus auxiliary function with the BCH method (Asparouhov and Muthén, 2014a, 2014b). Using the auxiliary function provides an opportunity to investigate differences between latent groups without impacting the final latent group solution. The group comparison was based on a Wald Chi-square test of statistical significance.

3. Results

Individual- and environment-related antecedents were measured in the early fall of Grade 9, and adolescents' usage activity and experiences in late fall after the intervention. Table 2 presents the means, standard deviations, and ranges of the observed variables. The amount of days participants used the program varied between a minimum of 1 and maximum of 20 days, with a mean of 5.9 days. Ninety percent of the participants used the intervention on 1 to 9 separate days during the intervention program.

3.1. Variable-oriented results: correlations and regression analyses

Our first research question examined the extent to which individual and environmental antecedents were associated with adolescents' usage activity and their experiences of the web-based Youth Compass intervention program. The correlations regarding individual-related antecedents, presented in Table 3, showed that compared to male adolescents, female adolescents had higher usage activity, were more satisfied with the intervention and were more likely to perceive the intervention as useful. Higher temperamental effortful control was related to higher usage and perceived usefulness. Higher academic achievement was related to higher usage activity and intervention satisfaction. Adolescents' stress before the intervention was connected with usage activity as such that adolescents experiencing higher stress used the program more often during the intervention than their less stressed counterparts did. In turn, life satisfaction and depressive symptoms before the intervention were not related to adolescents' usage activity or experiences of the intervention.

The correlations regarding environmental factors showed that higher peer acceptance was related to higher intervention satisfaction and perceived usefulness. Being rejected by one's peers, on the other hand, was not found to be connected to usage activity or experiences of the program. Adolescents experiencing a closer relationship with their mother reported being more satisfied with the intervention and had higher levels of perceived usefulness. An adolescent's closer relationships with their father and teachers were found to be related to higher levels of perceived usefulness. Activity, perceived usefulness, and satisfaction were all found to correlate with the adolescents' experiences of conflict with their teacher. That is, adolescents reporting higher levels

Table 2
Descriptive statistics of the observed variables (n = 161).

Variable	*M*	*SD*	Range
Individual-related antecedents			
Gender (% of males)	0.50	0.50	1.00
Effortful control	3.28	0.70	3.57
Academic achievement (self-reported GPA)	7.89	0.92	4.50
Stress	2.95	1.45	5.00
Depressive symptoms	7.08	7.38	29.00
Life satisfaction	3.54	0.93	4.00
Environment-related antecedents			
Mother's level of education	4.32	1.33	6.00
Father's level of education	3.87	1.50	6.00
Peer acceptance	4.56	2.69	13.00
Peer rejection	2.52	2.75	12.00
Perceived closeness with mother	3.66	1.04	4.00
Perceived closeness with father	3.26	1.10	4.00
Perceived closeness with teacher	1.85	0.70	3.00
Perceived conflict with mother	2.08	0.92	4.00
Perceived conflict with father	1.92	0.87	3.67
Perceived conflict with teacher	1.86	0.91	4.00
Adolescents usage activity and experiences of the intervention			
Usage activity (sum of days)	5.90	3.29	19.00
Perceived usefulness (scale 4–10)	6.86	1.50	5.43
Intervention satisfaction (scale 4–10)	7.45	1.42	6.00

Note. *M* = mean, *SD* = standard deviation. Gender coded as 0 = female, 1 = male.

Table 3
Correlations between individual- and environment-related factors and adolescents' usage activity and experiences of the Youth Compass intervention (n = 161).

Variable	Usage activity	Perceived usefulness	Intervention satisfaction
Individual-related factors			
Gender	−.27**	−.16*	−.25**
Temperamental effortful control	.16*	.23**	.14
Academic achievement (self-reported GPA)	.27**	.12	.18*
Stress	.18*	.03	.13
Depressive symptoms	.09	−.06	.08
Life satisfaction	−.06	.08	−.10
Environment-related factors			
Mothers' level of education	.05	.07	.06
Fathers' level of education	−.08	.02	.08
Peer acceptance	.13	.24**	.20*
Peer rejection	−.08	−.07	−.09
Perceived closeness with mother	.02	.27**	.19*
Perceived closeness with father	.08	.23**	.06
Perceived closeness with teacher	.07	.27**	.13
Perceived conflict with mother	−.02	−.08	−.10
Perceived conflict with father	−.06	−.03	−.08
Perceived conflict with teacher	−.27**	−.18*	−.28**

Note. Gender 0 = female, 1 = male.
* $p < .05$.
** $p < .01$.

of conflict with their teachers were more likely to be less active in using the intervention program, less satisfied with it, and to perceive it as less useful. Perceived conflict with parents, however, had no connection to usage activity or experiences of the intervention. Parents' level of education was also found to be unrelated to usage activity and experiences of the intervention.

Next, we carried out regression analyses to predict adolescents' usage activity and experiences of the Youth Compass intervention by individual- and environment-related antecedent factors. When antecedent factors were controlled for each other it was found that only the effects of gender (usage activity $\beta = -.20$, $SE = .67$, $p = .05$; perceived usefulness $\beta = -.29$, $SE = .30$, $p = .005$; intervention satisfaction $\beta = -.26$, $SE = .29$, $p = .01$) and temperamental effortful control (usage activity $\beta = .22$, $SE = .49$, $p = .05$; perceived usefulness $\beta = .38$, $SE = .22$, $p = .001$; intervention satisfaction $\beta = .28$, $SE = .21$, $p = .01$) were significant. The models' R^2 values for usage activity, perceived usefulness, and intervention satisfaction were .15, .19, and .16 respectively.

3.2. Person-oriented analyses: subgroups of adolescents in regard to their usage activity and experiences of Youth Compass

Our second aim was to examine what subgroups of adolescents can be identified based on their usage activity, perceived usefulness and satisfaction with the Youth Compass intervention program. A series of latent profile analyses (LPA) was conducted to identify subgroups and estimate the parameters for them. The fit of the model was evaluated by criteria based on BIC, aLRT, VLMR, and BLRT. Lower values of information criteria indicate a better model, and significant test results indicate a higher number of groups. Table 4 shows the LPA fit indices and class frequencies with different numbers of profiles.

Based on the fit indices, the four-group solution was concluded to fit the data best. Fig. 1 depicts the latent mean profiles of adolescents' usage activity, perceived usefulness, and satisfaction in Youth Compass intervention program.

Table 4
Fit indices and class frequencies for latent profile analyses with different numbers of latent profiles (n = 157).

No. of groups	BIC	p value of LMR	p value of VLMR	p value of BLRT
1 (N = 157)	1304.34			
2 ($n1$ = 48, $n2$ = 109)	1156.75	<.001	<.001	<.001
3 ($n1$ = 78, $n2$ = 30, $n3$ = 49)	1140.36	.060	.064	<.001
4 ($n1$ = 65, $n2$ = 29, $n3$ = 12, $n4$ = 51)	**1136.53**	**.020**	**.022**	**.05**
5 ($n1$ = 50, $n2$ = 64, $n3$ = 29, $n4$ = 11, $n5$ = 3)	1152.27	.333	.340	1.00

Note. BIC = Bayesian Information Criterion; LMR = Lo–Mendell–Rubin Adjusted Likelihood Ratio Test; VLMR = Vuong–Lo–Mendell–Rubin Likelihood Ratio Test; BLRT = Bootstrapped Likelihood Ratio Test.

According to their mean score profiles (Fig. 1), these groups were labelled: (1) 'satisfied' (average usage activity and high perceived usefulness and intervention satisfaction, 41% of participants), (2) 'dissatisfied' (low usage activity and very low perceived usefulness and intervention satisfaction, 18% of participants), (3) 'active' (very high usage activity and average perceived usefulness and intervention satisfaction, 8% of participants), and (4) 'moderate' (average usage activity and average perceived usefulness and intervention satisfaction, 33% of participants).

3.3. Person-oriented analyses: antecedents' associations with subgroup membership

Our final aim was to explore the associations of individual and environment-related factors with membership in subgroups regarding usage activity and experiences of the Youth Compass intervention program. The estimated means and standard errors and results for comparisons between the latent profiles in regard to individual and environmental factors are shown in Table 5.

There were relatively more male adolescents in the dissatisfied profile than in the other three profiles. The academic achievement of adolescents in the active profile was found to be higher compared to the dissatisfied and moderate profiles. No significant differences were found between profiles in regard to depressive symptoms or life satisfaction. In temperamental effortful control and stress, mean test scores across all the means were not significant, and only significant pairwise differences were found: temperamental effortful control was lower in the dissatisfied profile compared to the satisfied profile, and adolescents belonging to the active profile reported more stress than did those in the dissatisfied profile.

Adolescents in the satisfied and moderate profiles were found to have a closer relationship with their mother compared to adolescents in the dissatisfied profile. Adolescents in the dissatisfied profile had lower closeness to their teacher compared to those in the satisfied profile. Adolescent–teacher conflict was lower in the active profile than it was in the other three profiles. In addition, the perceived conflict between adolescent and teacher was found to be higher in the dissatisfied profile than in the satisfied profile. No differences were found between profiles in parents' education, peer rejection, or conflicts with parents. In peer acceptance and closeness with fathers, mean test scores across all the means were not significant, and only significant pairwise differences were found: peer acceptance was found to be lower among adolescents in the dissatisfied profile compared to those in the satisfied profile, and satisfied profile adolescents had a closer relationship with their father compared to those in the dissatisfied profile.

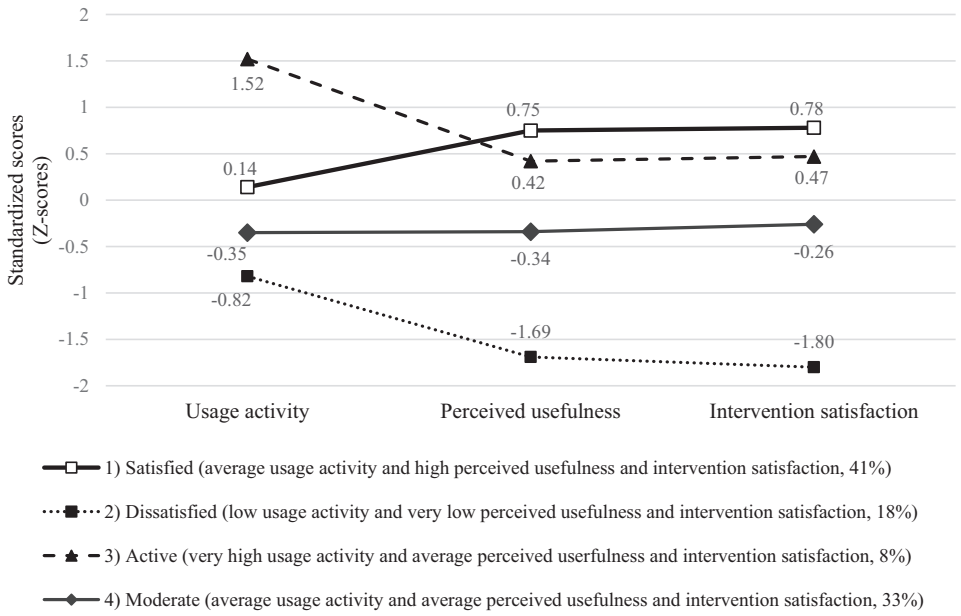

Fig. 1. Latent mean profiles of adolescents' usage activity and experiences of Youth Compass.

Table 5
Estimated means and standard errors and results for the comparisons between the latent profiles in regard to individual and environmental factors.

	1) Satisfied = Average activity and high perceived usefulness and intervention satisfaction (n = 65)		2) Dissatisfied = Low activity and very low perceived usefulness and intervention satisfaction (n = 29)		3) Active = Very high activity and average perceived usefulness and intervention satisfaction (n = 12)		4) Moderate = Average activity and average perceived usefulness and intervention satisfaction (n = 51)		$\chi 2(3)$	p
Variable	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*		
% of males	0.43	0.07	0.80	0.09	0.23	0.14	0.50	0.08	16.34	.001
Effortful control	3.48^{b}	0.10	3.13^{a}	0.14	3.24^{ab}	0.17	3.16^{ab}	0.12	5.78	.123
Academic achievement	8.06^{ab}	0.11	7.63^{b}	0.23	8.42^{a}	0.24	7.67^{b}	0.17	10.15	.017
Stress	2.81^{ab}	0.21	2.46^{a}	0.29	3.61^{b}	0.43	3.15^{ab}	0.25	5.61	.132
Depressive symptoms	7.00	1.14	4.73	1.24	9.48	2.76	7.61	1.22	4.29	.232
Life satisfaction	3.57	0.13	3.83	0.18	3.31	0.29	3.44	0.17	3.41	.333
Level of parental education	4.46	0.20	4.59	0.266	4.18	0.60	4.13	0.25	1.66	.647
Peer acceptance	0.17^{a}	0.14	-0.38^{b}	0.18	0.08^{ab}	0.28	-0.06^{ab}	0.14	6.38	.094
Peer rejection	0.17	0.16	0.20	0.22	0.01	0.27	0.18	0.16	0.33	.95
Closeness with mothers	3.96^{a}	0.14	3.07^{b}	0.22	3.33^{ab}	0.37	3.75^{a}	0.17	11.83	.008
Conflict with mothers	1.92	0.13	2.19	0.23	2.34	0.28	2.16	0.16	2.40	.494
Closeness with fathers	3.45^{a}	0.17	2.83^{b}	0.20	3.05^{ab}	0.38	3.31^{ab}	0.18	6.26	.099
Conflict with fathers	1.83	0.12	2.05	0.22	2.06	0.27	1.92	0.14	1.04	.793
Closeness with teachers	2.02^{a}	0.10	1.53^{b}	0.11	1.87^{ab}	0.31	1.84^{ab}	0.12	11.407	.010
Conflict with teachers	1.73^{a}	0.11	2.25^{b}	0.23	1.23^{c}	0.11	1.97^{ab}	0.16	25.60	<.001

Note. M = mean, SE = standard error. Means or proportions within a row sharing the superscripts (a through c) are pairwise significantly different at the level of $p < .05$.

4. Discussion

This study examined the usage activity, perceived usefulness and satisfaction of 15-year-old Finnish adolescents regarding Youth Compass, a five-week universal web-based acceptance and commitment therapy intervention program. Pre- and post-measurements were carried out during school hours and the adolescents used the intervention program on their own leisure time. In the current study, 82% of adolescents were moderately to highly active in using Youth Compass and rated their user experiences as average to high in terms of perceived usefulness and satisfaction with the program. The generally positive stance seems to be in line with findings from other studies on adolescents' views on web-based psychological intervention programs (Sweeney et al., 2019; Van Voorhees et al., 2009; Whittaker et al., 2012).

Regarding the first research question, the results of the regression analysis showed that especially adolescent gender and self-regulation were related to adolescents' usage activity, perceived usefulness and satisfaction (R^2 = .15, .19, and .16 respectively) with Youth Compass. In previous studies, the findings on gender have been mixed, but in those observing a connection between gender and adherence or perceptions of web-based psychological interventions (e.g., Garrido et al., 2019; Neil et al., 2009; Sweeney et al., 2019), the results have pointed in a similar direction as in this study. Female adolescents were found in the present study to be more active, have higher rates of satisfaction, and be more likely to perceive the intervention as useful compared to male adolescents. This could be seen as reflecting gender-based differences in receptiveness to health intervention strategies (Orji, 2014), suggesting that female adolescents may be more active Youth Compass users because the program is more appealing to them. Consequently, this highlights the need for web-based psychological intervention programs

to better account also for the interests of male adolescents and find appropriate motivation strategies (Garrido et al., 2019; Puolakanaho et al., 2019b). Measured in the present study in terms of temperamental effortful control, self-regulation showed associations with usage activity and perceived usefulness of the intervention. This finding supports previous results on self-regulation's role in achieving health-related outcomes (Berg et al., 2014; Miller et al., 2020), and implies that the Youth Compass program could potentially be more beneficial to adolescents with higher self-regulation skills because they are more likely to engage with the program material and its objectives. Higher perceived usefulness of the Youth Compass program could possibly be due to higher adherence facilitated by self-regulatory mechanisms. This raises the question of how a web-based psychological intervention program can respond to individually varying skill sets such as those relating to attention regulation or comprehension. To support this individualization, tailoring the program, for example, to better address users' personal needs has been suggested (Morrison et al., 2014; Neil et al., 2009).

Other associations between usage activity and intervention experiences were found with academic achievement, stress, peer acceptance, conflict with teacher, and closeness to parents and teacher. These, however, did not show significant predictability in regression analysis. No associations were found between intervention satisfaction or perceived usefulness and depressive symptoms, life satisfaction, parents' educational level, peer rejection, or perceived conflict with parents. Academic achievement's relation to usage and intervention experiences could be explained by the previously found higher uptake intentions (Lillevoll et al., 2014) and the tendency of students with higher average grades to participate more in extracurricular activities (Zaff et al., 2003). Close relationships to adults and peer acceptance were associated with intervention usage and experiences, whereas peer rejection and conflict, apart from conflict with teacher, were not. The result seems to support the view that positive interpersonal relationships may contribute to adolescent adherence (Gulliver et al., 2010; Kyngäs, 2007). In terms of rejection and conflict, teacher–student conflict was the only one to show associations with usage activity and intervention experiences. It is possible that teacher–student dynamics are more highlighted in the results if the intervention program has been associated by the participants with school-related work because pre- and post-measurements were made during schooldays. Parents' educational level, here reflecting socioeconomic status, was not associated with intervention usage or experiences, which is different to what has been suggested in previous studies on treatment adherence (see Kristensen et al., 2018; Nock and Ferriter, 2005). This difference could be explained by the fact that access to technology and mobile devices has rapidly grown and is not necessarily limited by socioeconomic status. Access to technology, consequently, allows access to treatment regardless of location or geographical distances.

In regards to psychological well-being, life satisfaction and the severity of depression symptoms were not found to be connected to usage activity or intervention experiences. Previous findings on adherence have different views on the relationship between pre-intervention depression severity and adherence (Batterham et al., 2008; Calear et al., 2013; Christensen et al., 2009; Korbel et al., 2007; Kristensen et al., 2018; Neil et al., 2009; Nock and Ferriter, 2005), but the current study differs from these by finding no association. One explanation for this could be that the Youth Compass program's purpose is to promote psychological well-being as a universal intervention among a community sample of adolescents, whereas previous research has mostly addressed web-based psychological intervention programs among clinical samples with specific diagnoses or clinically significant symptom levels. Results on life satisfaction and depression symptoms in relation to usage activity and intervention experiences could indicate that adolescents with varying levels of life satisfaction and depression symptoms would be as likely to commit to the intervention and to have positive intervention experiences. On the other hand, the present study found higher stress to associate with higher usage activity. In turn, Puolakanaho et al. (2019b) found adolescents with higher stress to experience greater positive gains from the Youth Compass intervention program. These results together suggest that adolescents who have higher distress may use the program more actively. An alternative explanation would be that initially stressed adolescents have stress also about the usage of the program that is shown as performance-orientation towards completing intervention exercises. In future studies it would be important to assess also the orientation how adolescents do the exercises, e.g. their attention, interest and affect (Perski et al., 2017; Short et al., 2018), in addition to usage activity.

Concerning our second aim, a person-oriented approach was used to describe adolescents' usage activity, perceived usefulness and satisfaction with Youth Compass. A series of latent profile analyses showed the solution of four subgroups to fit the data best. The subgroups were labelled ‘satisfied,’ ‘dissatisfied,’ ‘active,’ and ‘moderate’ according to their usage activity and intervention experience mean score profiles. Satisfied profile adolescents (41% of the participants) had an average level of usage activity and high perceived usefulness and intervention satisfaction. Dissatisfied profile adolescents (18% of the participants) had low usage activity and very low perceived usefulness and satisfaction rates. Active profile adolescents (8% of the participants) had very high usage activity and average rates in perceived intervention usefulness and satisfaction. Moderate profile adolescents (33% of the participants) had average rates on usage activity, perceived usefulness, and satisfaction.

Our third aim was to explore the associations of individual and environmental factors with subgroup membership regarding user activity and experiences of Youth Compass. The results showed gender, academic achievement, closeness to mother and teacher, and conflict with teacher to be meaningfully related to subgroup membership. There were more male adolescents in the dissatisfied profile compared to other profiles, which can be seen as reflecting the aforementioned gender-based differences, suggesting that Youth Compass does not appeal to male adolescents to the same extent it does to female adolescents. Adolescents with higher academic achievement were more likely to belong to the active profile. Despite active profile adolescents having high activity rates, they did not seem to show higher perceived usefulness or satisfaction rates compared to adolescents in the moderate profile. In addition, satisfied profile adolescents had higher ratings of perceived usefulness and satisfaction compared to active profile adolescents. Adolescents with low usage activity and very low perceived usefulness and satisfaction rates were associated with lower experienced closeness to their mothers compared to users with average activity and average or high perceived usefulness and satisfaction rates. The contrast between satisfied and dissatisfied profiles showed the biggest difference in terms of closeness to teachers in relation to perceived usefulness and satisfaction. In addition, higher experienced conflict with teachers was found in the dissatisfied profile compared to the satisfied profile. Adolescents of the active profile had, however, the lowest experienced conflict with teachers. One explanation for these differences could be that the intervention program material and exercises may be interpreted as schoolwork or the coaches' involvement as instructing similar to teaching situations. Associating the program with schoolwork may lead to usage that does not emerge based on a desire to affect health-related behavior. This could explain dissatisfied profile adolescents' low engagement and active profile adolescents' high activity without higher perceived usefulness or satisfaction to the intervention program. Despite no significant differences between groups, mean scores for stress, depression, and life satisfaction seemed to suggest that adolescents in the dissatisfied profile showed lower stress and depression and higher life satisfaction compared to other groups. This could be regarded as an implication that dissatisfied profile adolescents did not feel like they needed support for well-being. Alternatively, it could also reflect gender-based differences in prevalence of adolescent ill-being (Aalto-Setälä, 2010; WHO, 2018).

4.1. Limitations

The present study also has its limitations. Research in web-based psychological intervention programs requires a more robust consensus in measuring adherence and engagement (Donkin et al., 2011; Short et al., 2018; Sieverink et al., 2017). Different interpretations of what kind of program use can be seen as being more engaged or active may produce different results on what factors can predict it. This study used the concept of usage activity, measured by the amount of separate days an adolescent used the program. Usage activity is a complex entity and using only one measure to represent participants' program usage should be acknowledged as a possible limitation to the interpretation of results. In the future, usage activity or engagement could be determined based on a composition of measurements of, for example, time, activity, and task or module completion (Donkin et al., 2011; Short et al., 2018). The present study aimed to examine individual and environmental antecedents of the usage activity, perceived usefulness (i.e., learning of mindfulness, acceptance and value-related skills), and program satisfaction of adolescents participating in Youth Compass intervention program. Future studies should also address the possible moderating role of usage activity and intervention experiences in actual intervention efficacy. In the present study, the closest proxy to treatment outcome was to assess adolescent perceptions regarding learning mindfulness, acceptance and value-related skills, whose promotion is essential in ACT (Flaxman et al., 2013; Hayes et al., 1999; Twohig et al., 2010).

In addition, the present study lacks a deeper understanding of the adolescents' perspective on the Youth Compass program, such as surface credibility, which has been noted to affect adolescents' engagement and satisfaction with the program (Wozney et al., 2017). More information about this could be obtained by further inquiries about, for example, whether adolescents found the program easy to use or relatable. In generalizing these findings to other online interventions, it should be noted that the measures related to perceived usefulness and satisfaction were specific to the Youth Compass program. Furthermore, the adolescents' attitudes, beliefs and knowledge regarding web-based psychological intervention programs and mental health issues have not been discussed in the present study. Adolescents with lower knowledge of mental health problems have been found to hold more negative attitudes towards them (Sheffield et al., 2004). Beliefs, attitudes, and knowledge of web-based psychological intervention programs have been associated with intervention adherence (Marko-Holguin et al., 2010; Sweeney et al., 2019). Addressing beliefs, knowledge, and attitudes concerning mental health issues and web-based psychological interventions in research could provide important information on how universal interventions could be made more appealing for larger populations of adolescents to enhance their motivation to adhere to web-based psychological intervention programs. The conclusions in the current study are based on associations, and care must be taken to draw definite interpretations.

4.2. Conclusions

The results of the present study suggested the presence of different individual and environmental factors that may affect adolescent adherence (reflected in the present study by usage activity) to a web-based universal psychological intervention program and adolescent intervention experiences (reflected in the present study by ratings of perceived usefulness and program satisfaction). Moderate to high usage activity and/or intervention experience rates in the Youth Compass program seemed to be characterized by adolescents' female gender, higher self-regulation skills, good academic performance and positive relationships with adults near them. The results implied that adolescents with varying levels of life satisfaction and depression symptoms would be as likely to commit to the Youth Compass program, but adolescents with higher levels of stress would be more likely to commit to the program compared to their less stressed counterparts. On one hand, it seems likely that adolescents experiencing higher stress may be more motivated to seek support for their well-being. On the other hand, committing to the web-based psychological intervention program seems as likely for adolescents of varying levels of psychological symptoms.

In the future, web-based psychological intervention programs could take individually varying needs and adolescent gender into closer consideration (Garrido et al., 2019; Morrison et al., 2014; Neil et al., 2009). The roles of psychological symptom levels in predicting adolescent adherence and intervention experiences should be further investigated in future studies. . In addition, more research with varying age groups and clinical samples are required to extend knowledge concerning feasibility of the Youth Compass program. The results of the present study contribute to understanding what should be taken into account in making a web-based psychological intervention program appealing to as large population of adolescents as possible.

Ethical approval

This study was conducted in compliance with APA ethical standards and with the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. The study was approved by the Ethical Committee of the University of Jyväskylä and has been registered at ClinicalTrials.gov.

Informed consent

Informed consent was obtained from all the participants of the study.

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Data sharing and declaration

The datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

Declaration of competing interest

The authors declare that they have no conflict of interest. The authors have no financial relationship to the program under examination.

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II

THE ROLES OF ADHERENCE AND USAGE ACTIVITY IN ADOLESCENTS' INTERVENTION GAINS DURING BRIEF GUIDED ONLINE ACCEPTANCE AND COMMITMENT THERAPY

by

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The Roles of Adherence and Usage Activity in Adolescents' Intervention Gains During Brief Guided Online Acceptance and Commitment Therapy

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Disclosure Statement. The authors declare to have no conflict of interest. *Ethical Approval*. This study was conducted in compliance with APA ethical standards and with the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. The study has been approved by the Ethical Committee of the University of Jyväskylä and has been registered at ClinicalTrials.gov (NCT03274934). *Informed Consent*. Informed consent was obtained from all the participants of the study. *Funding*. Funding has been received from grants by the Finnish Cultural Foundation and the Academy of Finland (No. 266851, 324638). *Data Sharing*. The datasets generated and/or analyzed in this study are not publicly available but are available from the corresponding author on a reasonable request. *Corresponding Author*. Correspondence concerning this article should be addressed to Tetta Hämäläinen, Department of Psychology, University of Jyväskylä, P.O. Box 35, 40014 Jyväskylä, Finland. E-mail: tetta.s.hamalainen@jyu.fi

Abstract

Objective: This study investigated the roles of adherence and usage activity in adolescents' (n = 161) gains during a five-week web intervention program based on acceptance and commitment therapy (ACT). **Method**: Program adherence was calculated as adherence percentage in relation to intended usage, whereas completion percentage, usage time, and usage weeks were used as indicators for usage activity. Subjective well-being was measured by self-reported life satisfaction and stress before and after the intervention. **Results**: First, regression analysis results showed that higher adherence predicted an increase in life satisfaction during intervention. Second, three subgroups of adolescents were identified using *K*-means cluster analysis in regard to adherence, usage activity and intervention gains: (1) "Adhered, committed users with relatively large intervention gains" (35%), (2) "Less committed users with no intervention gains" (42%), and (3) "Non-committed users with no intervention gains" (23%). The results showed that the highest gains from the Youth Compass intervention program are most likely obtained when the program is used as intended in its design. In addition, time investment and engagement in doing exercises seem as important as filling the minimum adherence criterion. **Conclusions**: The results support the feasibility of ACT-based web intervention programs in promoting adolescent well-being, although more attention should be paid to motivating adolescents to commit to them and invest enough time in them.

Keywords: web-based psychological interventions, adolescents, adherence, usage activity, acceptance and commitment therapy

Introduction

Mental health problems are linked with increased risk for challenges in academic or work performance, difficulties in interpersonal relationships, substance abuse, violence, and suicide (Gladstone et al., 2015; Skeen et al., 2019). Around one in five adolescents struggle with mental health problems and half of all mental health problems experienced in adulthood have been estimated to have their onset during childhood or adolescence (Belfer, 2008; Skeen et al., 2019). Adolescents have low rates of seeking professional help due to barriers such as fear of stigma, discrimination, poor mental health literacy, or negative beliefs or experiences concerning mental health services (Aguirre Velasco et al., 2020; Gladstone et al., 2015).

The Internet offers an option for delivering psychological interventions to adolescents. A recent study using clinical and non-clinical samples found that majority of youth have positive attitudes towards web-based services for well-being and would be interested to access them (Hawke et al., 2021). Web-based programs hold some advantages compared to face-to-face treatment delivery, such as better accessibility, large-scale distribution of support, lack of travel time, and increased anonymity (Aguirre Velasco et al., 2020; Hawke et al., 2021; Michie et al., 2017).

Previous studies have shown support for web-based psychological intervention programs in enhancing adolescent well-being (Clarke et al., 2015; Gladstone et al., 2015; Välimäki et al., 2017). However, in some cases web-based intervention effects have been small or limited, which has been attributed to a lack of adherence, among other possible explanations (Donkin et al., 2011; Kelders et al., 2012). Research interest in the roles of adherence and usage activity in relation to intervention outcomes has been growing (Sieverink et al., 2017). In addition, attention has been paid to what counts as the minimum level of engagement in a program in order to achieve changes in target outcomes, namely, effective engagement (Michie et al., 2017; Miller et al., 2019; Yardley et al., 2016).

The purpose of the present study was to examine adolescents' adherence and usage activity in a school-based universal preventive intervention program that is based on acceptance and commitment therapy (ACT). The aim was to produce new information on the roles of adherence and usage activity in relation to intervention gains in a brief guided web-based psychological intervention program. In the present study, intervention gains were examined in terms of experienced improvement in subjective well-being (Diener, 1984; 2006). Improvement in subjective well-being was represented by increased life satisfaction and decreased stress (Moksnes et al., 2016).

ACT-Based Web Interventions in Promoting Subjective Well-Being

Acceptance and commitment therapy (ACT) is an acceptance-, mindfulness-, and values-based approach that focuses on increasing psychological flexibility. ACT promotes maintaining contact with the present moment and committing to actions that are consistent with one's own values (Hayes & Ciarrochi, 2015; Hayes et al., 1999). ACT has been considered effective in promoting well-being and treating various mental health issues among children and adolescents (Coyne et al., 2011; Halliburton & Cooper, 2015; Hancock et al., 2018; Harris & Samuel, 2020; Livheim et al., 2014; Petts et al., 2017).

Previously, improvements in well-being in terms of *increased life satisfaction* during ACT-based web intervention programs have been reported by studies on adolescents (Lappalainen et al., 2021), university students (Räsänen et al., 2016), and adults (Ahtinen et al., 2013; Lappalainen et al., 2014; Ljótsson et al., 2013). A few studies with adult samples have reported improvements in other psychological well-being indices but not in life satisfaction (Brown et al., 2016; Levin et al., 2015). In turn, improvements in well-being in terms of *decreased stress* during ACT-based web intervention programs have been reported by studies on adolescents (Puolakanaho et al., 2019), university students (Räsänen et al., 2016), and adults (Lappalainen et al., 2013; Levin et al., 2015; Öst, 2014). In sum, previous

literature suggests that ACT-based web intervention programs may increase life satisfaction and decrease stress. In addition to examining intervention effects on subjective well-being, previous literature has emphasized the need to better understand behavioral-level commitment within web-based psychological intervention programs, such as program usage and adherence to the programs (Kelders et al., 2012).

Adherence and Usage Activity in Web-Based Psychological Intervention Programs

Various concepts have been used in literature to describe web-based psychological intervention program engagement and usage (e.g., see Donkin et al., 2011; Kelders et al., 2012; Short et al., 2018). The present study used the concepts of *adherence* and *usage activity*. Adherence was defined in the present study in relation to the intended usage of the program, that is, the extent to which a program is advised to be used according to its designers (Donkin et al., 2011; Kelders et al., 2012; Sieverink et al., 2017). Usage activity represented the extent of usage, that is, how long the program was used and how much of the program was completed in relation to all program content (see also Couper et al., 2010; Danaher et al., 2006; Morrison et al., 2014; Perski et al., 2017).

To our knowledge, no prior studies have examined the roles of adherence and usage activity in adolescents' gains from web-based ACT interventions. However, preliminary information was drawn from studies using adult participants as well as other types of web-based psychological intervention programs. Van Gemert-Pijnen et al. (2014) found a higher number of logins per lesson to predict lower adult depression symptoms at post-measurement in a nine-lesson ACT-based program. Mattila et al. (2016) found adult gains in psychological flexibility to be linked with higher ACT-based mobile application usage time and a greater number of sessions, exercises, days, and weeks. Other studies, mostly on web interventions based on cognitive behavioral therapy (CBT), have associated better intervention outcomes with a higher number of completed exercises or modules, usage weeks, total usage time, the

number of opened pages, logins, or use of reminder functions (Donkin et al., 2011; 2013; Enrique et al., 2019; Manwaring et al., 2008; Whitton et al., 2015).

Research Questions and Hypotheses

The present study investigated the roles of adolescent adherence and usage activity in relation to intervention gains in a program called *Youth Compass*. The Youth Compass is an ACT-based psychological web intervention program designed to support adolescent well-being (see the Method section for a more detailed description of the intervention program). The research questions were as follows:

(1) To what extent do adherence to and usage activity of the Youth Compass program predict intervention gains regarding adolescent psychological well-being (i.e., life satisfaction, stress)? H1: It was expected that higher adherence to and usage activity of the Youth Compass program would be related to greater gains in adolescent psychological well-being (i.e., increased life satisfaction, decreased stress) during the intervention.

(2) What kinds of subgroups of adolescents can be identified based on their adherence, usage activity, and intervention gains in psychological well-being? H2: It was expected that the participants would show different patterns in terms of their adherence, usage activity, and intervention gains (Sanatkar et al., 2019). However, due to the lack of previous research, no specific preliminary assumptions were made concerning the number of resulting subgroups.

Method

Participants and Procedure

A total of 161 ninth-grade Finnish adolescents took part in the five-week ACT-based web intervention program called Youth Compass. Written consent was obtained from the participants and their parents during spring of 2017 and the intervention was carried out during fall of 2017. Sample selection and randomization were conducted in two parts. First, a

subsample was randomized from a longitudinal project's general adolescent population sample (STAIRWAY study, around 800 participants). Second, the participants were randomized into two intervention groups: a group with online support and minimal face-to-face contact (n = 83) and a group with only online support (n = 82). The randomized groups did not significantly differ from each other, that is, the randomization was successful (see also Puolakanaho et al., 2019). Four randomized participants (two in each group) did not attend the pre-intervention measurement. Another four participants did not attend the post-intervention measurement in the group with online support and minimal face-to-face contact. The group with only online support remained the same for post-intervention measurement. Participants received a brief introduction and an instructions sheet with credentials and the program timetable.

Online and face-to-face contact were provided to participants by personal coaches. The coaches were bachelor's and master's level psychology students who had been trained for 18 hours on the ACT approach prior to the intervention. The coaches had weekly access to a licensed psychologist's supervision during the intervention. Participants who received face-to-face contact had two 45-minute meetings with their coach (before and after the intervention). The first meeting consisted of a structured interview and discussion concerning the participant's current life situation (adapted from a psychosocial interview template; see Strosahl et al., 2012), and the second meeting was about intervention experiences. The Youth Compass program composition and online support were the same for both intervention groups. Online support was provided in the form of weekly feedback via instant text messages. The feedback consisted of three semi-structured questions. The first two questions were the same each week: (1) How are you doing? and (2) Please rate your mood during the last week on a scale from 4 to 10 (4 = *very bad*, 10 = *very good*; 4 to 10 scale was familiar to participants because it is commonly used for grading in the Finnish education system). The

third question changed according to the week's theme (e.g., for the first intervention week: "What is important to you? What could you do today or tomorrow to add joy and energy in your life? Do it!").

The type of support provided by the coaches (online support or online support and minimal face-to-face contact) was not found to contribute in a statistically significant manner to adolescents' adherence, usage activity, subjective well-being, or intervention gains ($p > .05$ for all). Therefore, the type of intervention group was not included in the subsequent analyses of this study. The present study thus analyzed all participants as one group ($n = 161$). Table 1 presents demographic information of the study participants.

The Intervention Program

The Youth Compass program consisted of five modules (see Lappalainen et al., 2021; Puolakanaho et al., 2019 for more information concerning the program's content and structure). Each module presented a different ACT-based theme: (1) finding personal interests, (2) promoting self-awareness, skills of acceptance, and cognitive defusion, (3) being in the present, (4) self as context and self-compassion, and (5) applying important actions to one's social life and compassion toward others. All modules were divided into an introduction and three sections containing exercises. The program included short texts, audio and video clips, and comic strips. The program was designed to fit adolescents by having an interactive feel and short exercises. The exercises were designed to take around five minutes each at maximum, and most of them were provided in written and audio form. To complete a module, a participant had to complete at least six exercises (two exercises in each section). All modules also had voluntary exercises which the participant could do in addition to the recommended ones. In total, participants were instructed to complete at least 30 exercises out of a selection of over 90 exercises during the five-week intervention. This would mean spending around 15 to 30 minutes per week in the program.

Measures

Objective measures of usage activity and program adherence were calculated after the intervention program based on the actual adherence and usage activity during the intervention. Measurements for subjective well-being were collected before (i.e., pre-intervention measurement in early fall of Grade 9) and after (i.e., post-intervention measurement in late fall of Grade 9) the five-week intervention. The gap between the pre- and post-intervention measurements was seven weeks.

Adherence in the Youth Compass Program

Adherence Percentage. Adherence percentage was defined as intended usage, that is, the extent to which exercises were completed according to the recommended schedule (see also Kelders et al., 2012; Sieverink et al., 2017). The participants were recommended to complete two mandatory exercises in each of the five modules' three sections within the intervention period (30 exercises in total; six exercises per week; the duration of each exercise was designed to be approximately two to five minutes). In addition, participants could freely complete an optional number of voluntary exercises (the total number of voluntary exercises available during the intervention program was 68, that is, around 12–15 exercises per module, including the feedback forms at the end of each module). Exercises were marked as completed either when input was saved on the exercise page (for exercises requiring input) or when an exercise page was accessed (for exercises not requiring input). Adherence was calculated as the proportion (%) of the recommended exercises the participant completed. A higher percentage indicated higher adherence.

Usage Activity in the Youth Compass Program

Three indices were used to measure different aspects of adolescents' usage activity in the intervention program (see also Michie et al., 2017; Perski et al., 2017).

Completion Percentage. Completion percentage was calculated as the sum of completed exercises in relation to all available exercises. A higher completion percentage indicated a higher amount of completed exercises within all program content, regardless of whether they were voluntary.

Usage Time. Total usage time was measured as the sum of program usage in minutes during the intervention period. The usage time was an estimation, calculated based on the usage log that contained timestamped entries of the participants' actions in the web-based intervention program. Such actions included viewing or refreshing a page, completing an exercise, and accessing the journal. The usage time was calculated as the cumulative time between the log entries. Breaks of 10 or more minutes between consecutive log entries were excluded from the cumulative time, except for 10–15-minute breaks, which were clearly associated with saving a long textual input in an exercise or watching/listening to a long exercise. This was because the program's exercises were designed to take at most ten minutes to complete, so long pauses indicated that the participant was not actively engaged with the program.

Usage Weeks. In contrast to the adherence and usage activity measures that describe the total amount of usage, usage weeks comprised an indicator of usage frequency. Usage weeks were measured as the number of separate weeks during which the participants accessed the intervention program, regardless of the number of accesses during that week. For example, if a participant accessed the program once per week for five weeks and another participant accessed the program twice per week for five weeks, both would have five usage weeks.

Subjective Well-Being

Life Satisfaction. The participants' life satisfaction was measured with the Finnish version of the Satisfaction with Life Scale (SWLS; Diener et al., 1985; see also Mauno et al.,

2018; Pavot et al., 1991). The scale consists of five items, which are answered on a scale from 1 to 5 (e.g., "The circumstances in my life are excellent." 1 = *completely disagree*, 5 = *completely agree*). Mean scores were calculated from the items (Cronbach's α = .92) separately for pre- and post-intervention (the range of the scale is 1–5). A higher value indicated a higher level of life satisfaction.

Stress. First, stress was explained to the participants in written form as referring to "a situation where people feel tense, restless, nervous, or anxious and have difficulties sleeping due to the things wandering in their mind." Next, the participants answered the question "Do you feel this kind of stress at the moment?" on a scale from 1 to 6 (1= *not at all*, 6 = *very much*; see Elo et al., 2003). Scores of 4 and above were considered to indicate high stress (Fredriksson-Larsson et al., 2015; Jonsdottir et al., 2010). Validity of the single-item stress measure is supported by its congruence with other mental health scales, such as the General Health Questionnaire (GHQ) and 36-Item Short Form Survey (SF–36) (Elo et al., 2003).

Analysis Strategy

All analyses were conducted with IBM SPSS Statistics software version 26. The first research question (that is, roles of adherence and usage activity in predicting intervention gains) was investigated with correlations and regression analyses. The second research question (that is, identification of subgroups based on adherence, usage activity, and intervention gains) was investigated with a person-oriented approach. Instead of addressing the associations between variables at a group level (i.e., a variable-oriented approach), a person-oriented approach examines patterns of information on an individual level and identifies subgroups based on pattern similarity (Bergman et al., 2003).

K-means cluster analysis was used to form the subgroups. First, multivariate outliers inside the data set were detected by Mahalanobis distance (Vargha et al., 2016; Zakharov, 2016). One case was identified as an outlier and thus excluded. The number of missing cases

for changes in life satisfaction and/or stress was 10. Thus, a total of 150 participants were included in the cluster analyses. Next, standardized values of adherence percentage, completion percentage, usage time, usage weeks, change in life satisfaction, and change in stress were set as variables determining cluster formation. Solutions of two to six subgroups were investigated. Selecting the best fitting solution was based on examinations of the subgroup membership sizes, the number of iterations, analysis of variance (ANOVA), and the variance ratio criterion (VRC; Caliński & Harabasz, 1974; Sarstedt & Mooi, 2019). VRC values, where a larger value represents better fit, were calculated by summing the variables' *F*-values from a one-way ANOVA (Sarstedt & Mooi, 2019). After selecting the best fitting solution, the following cutoffs were used to evaluate the magnitude of intervention gains: 0.2 standard deviation (*SD*) indicates a small effect, 0.5 *SD* indicates a medium or moderate effect, and 0.8 *SD* indicates a large effect (Cohen, 1988; Middel & van Sonderen, 2002). Last, a Tukey HSD post-hoc test was used to compare the groups in terms of subjective well-being and intervention gains.

Results

Table 2 presents the descriptive information on the participants' Youth Compass program adherence, usage activity, and subjective well-being. The mean usage time for all participants during the five-week intervention period was around 84 minutes. Full adherence (i.e., adherence of 100%) was demonstrated by 42% of participants within the sample, meaning that nearly half of the participants fully followed the intended usage (i.e., completed at least 30 exercises) of the Youth Compass intervention program. The number of usage weeks was higher than five for some participants, because they may have had other engagements during the intervention, such as an exam week, illness, or a holiday trip; these participants were allowed to complete the program and access time was allowed beyond the five weeks in accordance with the delays.

Variable-Oriented Results: Adherence and Usage Activity in Relation to Intervention Gains

Table 3 shows the observed correlations of adherence and usage activity with subjective well-being. The correlations indicated that participants with a higher adherence percentage were more likely to show higher pre-intervention stress, and an increase in their life satisfaction during the intervention. Participants with a higher completion percentage were also more likely to experience an increase in life satisfaction. A higher total usage time was associated with participants' higher pre-intervention stress. Participants with a higher number of usage weeks were more likely to show higher rates of pre- and post-intervention stress. No correlations were found for adherence or usage activity measures in relation to pre- or post-intervention life satisfaction or change in stress.

Regression analyses were carried out to examine the linear effects of adherence and usage activity in intervention gains. When controlled for the effect of pre-intervention life satisfaction (β = -.452, $t(1, 153)$ = -6.259, SE = .048, $p < .001$, R^2 = .204), adherence percentage (β = .144, $t(2, 152)$ = 2.006, SE = .001, p = .047, R^2 = .224, R^2 change =.021) was found to be significant in relation to change in life satisfaction. In other words, the results indicated that participants were more likely to experience an increase in their life satisfaction if they followed the intended usage. Usage activity indices (i.e., completion percentage, usage time, and usage weeks) showed no significant effect in relation to change in life satisfaction. No significant effects by adherence or usage activity indices were identified in relation to change in stress.

Person-Oriented Results: User Subgroups Based on Adherence, Usage Activity, and Intervention Gains

Subgroups were formed based on standardized scores of adherence percentage, completion percentage, usage time, usage weeks, change in life satisfaction, and change in stress.

Solutions of two to six subgroups were examined. The two-group solution was shown in ANOVA to divide the participants into groups based on adherence and usage activity, but no significant differences were shown in intervention gains. In contrast, other solutions showed differences in ANOVA in terms of all variables, which reduced the two-group solution's fit to data. Three- and four-group solutions seemed to have better membership distributions compared to five- and six-group solutions: the five-group solution had a group of 9 participants and the six-group solution had groups of 10 and 13 participants, which were considered too small for further investigation. The three-group solution seemed to have a better fit because it achieved convergence with less iterations compared to the four-group solution. Lastly, VRC values were compared between all subgroup solutions (see Table 4). Based on ANOVA, membership sizes, iterations, and VRC values together, the three-group solution was determined as to fit the data best.

Next, subgroups within the chosen solution were named based on their profiles of adherence, usage activity, and intervention gains. The groups were labeled as follows:

Group 1: "Adhered, committed users with relatively large intervention gains" (*n* = 52; 35% of participants). The participants in this group had high adherence (93%) and high usage rates. The group also showed the highest investment in usage minutes (126 min). The group obtained significant gains in psychological well-being, manifested as increased life satisfaction and decreased stress symptoms.

Group 2: "Less committed users with no intervention gains" (*n* = 63; 42% of participants). The participants in this group showed high adherence (92%) and completion rates but did not invest as much time in minutes (94 min) to the program. Stress increased at post-intervention. No significant changes in life satisfaction were identified.

Group 3: "Non-committed users with no intervention gains" (*n* = 35; 23% of participants). The participants in this group had low adherence rates (10%) and did not show gains in psychological well-being from the intervention program.

Table 5 presents more detailed information on all variables in the form of non-standardized and standardized means and standard deviations. Figure 1 illustrates the subgroup profiles in terms of standardized values used in subgroup formation. Some differences in demographics were also identified between the different profiles of adolescents in regards to adherence, usage activity and intervention gains. Adhered, committed users with relatively large intervention gains (i.e., Group 1) had more female adolescent participants and Non-committed users with no intervention gains (i.e., Group 3) had more male adolescent participants, whereas gender-based differences were not present in Less committed users with no intervention gains (i.e., Group 2). No other significant differences in terms of demographics were observed between the groups.

The Tukey HSD post-hoc test showed that Adhered, committed users with relatively large intervention gains had a lower level of pre-intervention life satisfaction compared to Less committed users with no intervention gains ($p < .001$) and Non-committed users with no intervention gains ($p < .05$). Adhered, committed users with relatively large intervention gains experienced an increase in life satisfaction during intervention, which differed from the near zero changes of Less committed users with no intervention gains and Non-committed users with no intervention gains ($p < .001$). No significant differences between groups were observed for post-intervention life satisfaction.

In terms of stress, the post-hoc test showed that Adhered, committed users with relatively large intervention gains had greater pre-intervention stress compared to Less committed users with no intervention gains and Non-committed users with no intervention gains ($p < .001$). Adhered, committed users with relatively large intervention gains

experienced a decrease in stress, Less committed users with no intervention gains experienced an increase in stress, and Non-committed users with no intervention gains experienced no changes in stress. Differences in changes in stress were significant between all groups: Adhered, committed users with relatively large intervention gains differed on a level of $p < .001$ from the other two groups. The difference between Less committed users with no intervention gains and Non-committed users with no intervention gains was on a level of $p < .05$. No significant differences between groups were observed for post-intervention stress.

Discussion

The present study investigated the roles of adolescent adherence and usage activity in an ACT-based web intervention program. To our knowledge, no previous studies have examined how adolescent adherence and usage activity in a brief guided ACT-based web intervention program predict intervention outcomes in terms of gains in psychological well-being.

Discussion of Principal Findings

The adherence and usage activity rates indicated that majority of participants were to a large extent committed to the program. Nearly half of the participants fully adhered to the intervention program (i.e., followed the intended usage of the program that was demonstrated by adherence percentage). It is possible that the presence of reminders and messages sent by the coaches upheld commitment to the program, as has been suggested in previous studies concerning reminders during intervention (Ryan et al., 2017; Whitton et al., 2015).

The first research aim was to investigate the roles of adherence and usage activity in predicting intervention gains. Regression analyses indicated a higher adherence percentage to predict an increase in life satisfaction. These results showed support for the hypothesis (H1) and seem to fall in line with a previously proposed association between adherence and intervention outcomes (Calear et al., 2013; Donkin et al., 2011; Hogue et al., 2008). Also,

Lappalainen et al. (2021) reported increased life satisfaction for participants who adhered to the Youth Compass program by completing at least half of the intervention program (i.e., completing tasks in at least three out of five modules). The present study expanded on this by investigating in more detail how adherence and usage activity indices are associated with intervention gains. In turn, contrary to our expectations, no associations were detected between change in stress and adherence or usage activity indices. One explanation for this could be that the used index for adolescents' stress was not sensitive enough to tap into changes. Another explanation could be that the outcomes were influenced by subjective engagement, that is, the experienced usefulness of the program, expected gains from adherence, or content-related factors such as timeliness or previous interest in increasing well-being.

The second research aim was to identify subgroups based on the participants' adherence, usage activity, and intervention gains in psychological well-being (indicated by changes in life satisfaction and stress). Differing patterns were detected, as was hypothesized (H2), and the solution of three subgroups fit the data best. "Adhered, committed users with relatively large intervention gains" (i.e., Group 1) showed high adherence and usage activity, and experienced an increase in life satisfaction and a decrease in stress. "Less committed users with no intervention gains" (i.e., Group 2) showed high adherence and completion rates but did not invest as many minutes in the program, and experienced a slight increase in stress. "Non-committed users with no intervention gains" (i.e., Group 3) did not use the program as intended and did not experience changes in life satisfaction or stress. Adhered, committed users with relatively large intervention gains experienced a substantial improvement in their life satisfaction, whereas the other groups did not show significant changes in life satisfaction. However, the three groups differed from each other in terms of changes in stress: Adhered, committed users with relatively large intervention gains experienced a decrease in

their stress, while Less committed users with no intervention gains experienced a substantial increase in their stress, and Non-committed users with no intervention gains experienced no changes in stress.

A previous study by Sanatkar et al. (2019) investigated usage data in a CBT-based self-guided web intervention program for adult stress, anxiety, and depression symptoms. They identified three subgroups somewhat similar to the present study's groups, but contrary to the present study, they did not have users with very low commitment. The difference from the present study could be explained by different samples, because Sanatkar et al. (2019) focused on motivated participants who themselves initiated signup in the intervention program. Sanatkar et al. (2019) observed all subgroups as showing equivalent improvements and suggested higher overall engagement to be connected with faster symptomatic improvements. In sum, the results of the study by Sanatkar et al. (2019) and the present study seem to support roles of adherence and usage activity as important contributors to intervention gains.

Despite similar-looking adherence and usage activity patterns, Adhered, committed users with relatively large intervention gains and Less committed users with no intervention gains experienced different changes in psychological well-being. Additional comparisons were thus made to further investigate the reasons behind this. Comparisons of variances showed Adhered, committed users with relatively large intervention gains to differ in terms of usage time on a level of $p < .001$ from Less committed users with no intervention gains. Adhered, committed users with relatively large intervention gains used the program for an average of 126.72 minutes and Less committed users with no intervention gains for an average of 94.07 minutes. On a weekly level, this would mean around 24–25 minutes of usage per week for the former group and around 18 minutes per week for the latter. Other differences between the two groups were not detected in terms of adherence percentage,

completion percentage, or usage weeks. Therefore, it seems that Adhered, committed users with relatively large intervention gains and Less committed users with no intervention gains used the program in otherwise similar ways, but the former group used more time in it compared to the latter. It is possible that Less committed users with no intervention gains treated the intervention program as a homework-like performance, were not motivated to use any more time to process the intervention program content, or lacked time to deeply engage with the exercises. Because Adhered, committed users with relatively large intervention gains had lower pre-intervention life satisfaction and higher pre-intervention stress (the mean score was close to the threshold of score indicating high stress) compared to the other two groups, it is possible that Adhered, committed users with relatively large intervention gains also had a higher need to increase their well-being and thus were more motivated to engage to the program.

It seems possible that dedicating time to doing exercises is as important as following the intended pace and exercises in a web-based psychological intervention program. In addition, motivation for program usage could possibly be connected to experiences of lower subjective well-being, i.e., adolescents experiencing challenges in their psychological well-being might be more likely to commit to a web-based psychological intervention program. Interestingly, these observations were achieved by the person-oriented approach while remaining undetected in the variable-oriented results. This could be considered a demonstration of the strengths of using the person-oriented approach. The subgroup profiles and statistically significant differences between them in terms of change in stress could also explain why the first hypothesis (H1) was not supported in terms of change in stress.

Limitations and Proposals for Future Research

This study was not without limitations. Stress measurement was based in this study on a single-item scale, which can limit the interpretations made concerning the results. The sample

was a non-clinical sample selected from a general adolescent population. Future studies are needed concerning the role of adherence and usage activity in intervention gains for different kinds of adolescent samples, including clinical samples and with additional well-being indices. More knowledge is needed about how to encourage and support the engagement of different types of users in web-based psychological intervention programs. In addition, further research is needed on how to tailor programs to better fit different users.

Possible participant barriers to or facilitators of program engagement were not addressed in the present study. It was concluded that time investment possibly plays a role in intervention gains, but the reasons underlying time investment were not investigated in the present study. It has been recommended that users' subjective experiences be included in measurements of adherence and usage activity, as they provide complementary information on user perceptions (Michie et al., 2017). Indeed, including subjective measures of engagement alongside objective adherence and usage measures would offer a fuller view on adolescents' motivation and perceptions regarding a web-based intervention program. Thus, using subjective measures could contribute to understanding factors that support or prevent engagement to a web-based psychological intervention program.

In the future, more research is needed to establish what constitutes a sufficient level of engagement in a web-based psychological intervention program (i.e., effective engagement). Also, identifying more accurate indicators for actual exposure to web-based psychological intervention program content is of great importance (Donkin et al., 2011). Future research could investigate in more detail the types of accessed exercises or patterns of engagement during the intervention period.

Conclusions

Previous research has indicated that ACT-based web intervention programs have positive effects on adolescent psychological well-being. The present study aimed to investigate the

roles of adherence and usage activity in relation to intervention gains, here demonstrated by increased life satisfaction and decreased stress. Novel understanding was achieved concerning how adherence and usage activity are associated with gains obtained during a brief guided ACT-based web intervention program. Variable-oriented results showed that higher program adherence was related to greater intervention gains. Comparisons of the identified subgroups showed that two groups with similar adherence and usage activity rates but with different intervention gains differed significantly in total program usage time. Thus, time investment was concluded to also contribute to intervention gains.

The present study emphasizes the importance of understanding adherence and usage activity in web-based psychological intervention programs in a larger context than just completion or drop-out rates. We concluded that greater intervention gains in adolescent psychological well-being are more likely to occur in an ACT-based web intervention program when participants use the program as has been intended, engage, and put enough time into doing the program exercises. Time investment and orientation to doing exercises seem as important as filling the minimum adherence criterion. In the future, more attention could be paid toward supporting participant motivation to using intervention programs and commitment to intended usage.

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Table 1

Study Participants' Demographic Information

Characteristic	All participants (*n* = 161)
Age *M* (*SD*, Range)	15.26 (0.32, 1.92)
Gender	
Female *n* (%)	81 (50.3)
Male *n* (%)	80 (49.7)
Mother tongue	
Finnish *n* (%)	151 (93.8)
Other than Finnish *n* (%)	6 (3.7)
Bilingual *n* (%)	3 (1.9)
Lives with	
Mother and father *n* (%)	111 (68.9)
Mother or father *n* (%)	16 (9.9)
Alternately with mother and father *n* (%)	23 (14.3)
Other[a] *n* (%)	7 (4.3)
Mother's education level[b] *M* (*SD*)	4.32 (1.33)
Father's education level[b] *M* (*SD*)	3.87 (1.50)

Note. *M* = mean, *SD* = standard deviation, Range = observed range within the variable.

[a] Participant lives with mother and stepfather, father and stepmother, in foster care, or in approved home.

[b] Education level on a scale of 1 to 7, where 1 = *no vocational training*, 7 = *postgraduate degree (i.e., licentiate, doctorate)*.

Table 2

Variability in Adolescents' Adherence, Usage Activity, and Well-Being in Youth Compass

Variables	*M*	*Mdn*	Mode	*SD*	Range	Min	Max
Adherence							
Adherence percentage	71.60	93.30	100.00	38.06	100.00	0.00	100.00
Usage activity							
Completion percentage	64.45	78.60	100.00	36.47	100.00	0.00	100.00
Usage time (minutes)	84.38	79.33	0.00	62.20	291.33	0.00	291.33
Usage weeks	4.47	5.00	5.00	1.89	8.00	0.00	8.00
Subjective well-being							
Life satisfaction							
Pre (T1)	3.54	3.60	4.00	0.93	4.00	1.00	5.00
Post (T2)	3.68	3.80	3.00	0.85	3.40	1.60	5.00
Change (T2-T1)	0.12	0.20	0.00	0.62	4.40	-2.40	2.00
Stress							
Pre (T1)	2.95	3.00	2.00	1.45	5.00	1.00	6.00
Post (T2)	2.80	3.00	3.00	1.25	5.00	1.00	6.00
Change (T1-T2)	0.15	0.00	0.00	1.13	8.00	-4.00	4.00

Note. *M* = mean, *Mdn* = median, Mode = most frequently observed value, *SD* = standard deviation, Range = observed range within the variable, Min = minimum, Max = maximum. Pre (T1) = pre-intervention. Post (T2) = post-intervention.

Change in life satisfaction was calculated as T2-T1, where a positive result indicates an increase in life satisfaction. Change in stress was calculated as T1-T2, where a positive result indicates a decrease in stress.

Table 3

Pearson Correlations of Adherence and Usage Activity Variables with Well-Being Variables

	Adherence	Usage activity		
	Adherence percentage	Completion percentage	Usage time (minutes)	Usage weeks
Subjective well-being				
Life satisfaction				
Pre (T1)	-.06	-.06	-.05	-.06
Post (T2)	.04	.03	.00	.01
Change (T2-T1)	.18*	.18*	.13	.15
Stress				
Pre (T1)	.16*	.14	.17*	.20*
Post (T2)	.13	.11	.12	.19*
Change (T1-T2)	.05	.05	.07	.02

Note. Pearson correlations of measures of adherence and usage activity in the Youth Compass program with pre-intervention, post-intervention, and changes between pre- and post-intervention stress and life satisfaction. Pre (T1) = pre-intervention. Post (T2) = post-intervention. Change in life satisfaction was calculated as T2-T1, where a positive result indicates an increase in life satisfaction. Change in stress was calculated as T1-T2, where a positive result indicates a decrease in stress.

* $p < .05$.

Table 4

Calculated Variance Ratio Criterion (VRC) Values for Each Investigated Subgroup Solution

	F-values				
Variable	2 groups	3 groups	4 groups	5 groups	6 groups
Adherence percentage	1227.15	652.92	415.77	332.22	264.42
Completion percentage	752.74	371.88	255.36	193.05	163.95
Usage time (minutes)	115.09	67.03	80.94	56.10	26.44
Usage weeks	240.36	121.53	80.98	63.60	52.89
Change in life satisfaction	4.47	18.96	42.00	46.12	31.26
Change in stress	0.17	37.85	11.01	18.94	41.46
VRC value	2339.98	1270.17	886.06	710.03	580.42

Note. VRC is calculated with SPSS statistics software as the sum of *F*-values across the ANOVAs, where a greater value is seen as a better fit to the data (Sarstedt & Mooi, 2019). Based on ANOVA, membership sizes, iterations, and VRC values, the three-group solution was determined to fit the data best, despite the two-group solution having a higher VRC value.

Table 5

Non-Standardized and Standardized Means and Standard Deviations for Subgroups

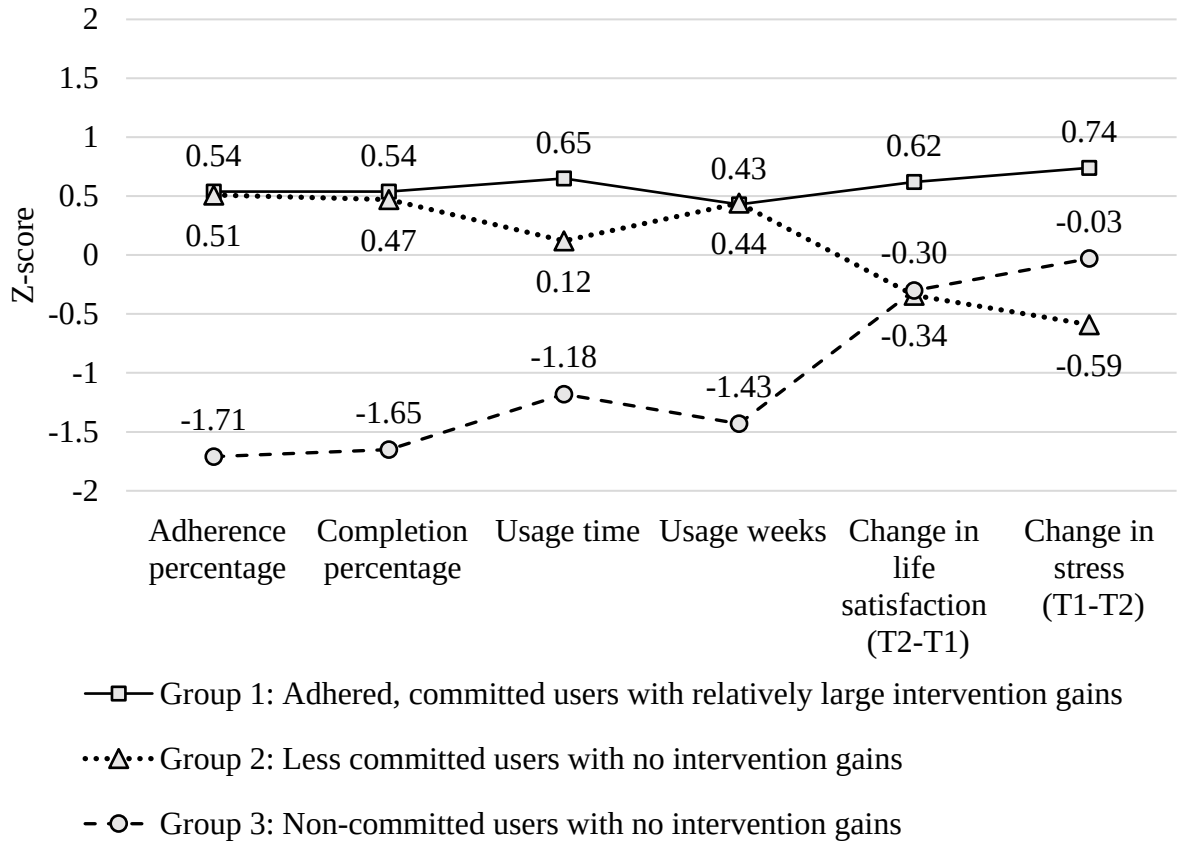
Measure	Group	Non-standardized		Standardized	
		M	*SD*	*M*	*SD*
Adherence					
Adherence percentage	Group 1 (*n* = 52)	93.27	11.06	0.54	0.30
	Group 2 (*n* = 63)	92.33	12.51	0.51	0.34
	Group 3 (*n* = 35)	10.86	11.27	-1.71	0.31
Usage activity					
Completion percentage	Group 1	85.91	15.40	0.54	0.43
	Group 2	83.54	15.94	0.47	0.45
	Group 3	8.37	9.42	-1.65	0.27
Usage time (minutes)	Group 1	126.72	54.47	0.65	0.88
	Group 2	94.07	46.74	0.12	0.76
	Group 3	14.36	16.43	-1.18	0.27
Usage weeks	Group 1	5.37	1.09	0.43	0.59
	Group 2	5.38	0.96	0.44	0.52
	Group 3	1.97	1.45	-1.43	0.79
Subjective well-being					
Life satisfaction					
Pre (T1)	Group 1	3.14	0.92	-0.42	0.99
	Group 2	3.79	0.83	0.28	0.89
	Group 3	3.65	0.93	0.13	1.01
Post (T2)	Group 1	3.66	0.84	-0.04	0.99

Measure	Group	Non-standardized		Standardized	
		M	*SD*	*M*	*SD*
	Group 2	3.75	0.83	0.07	0.98
	Group 3	3.63	0.90	-0.07	1.06
Change (T2-T1)	Group 1	0.52	0.61	0.62	1.04
	Group 2	-0.04	0.40	-0.34	0.68
	Group 3	-0.02	0.59	-0.30	1.01
Stress					
Pre (T1)	Group 1	3.92	1.34	0.66	0.92
	Group 2	2.40	1.16	-0.38	0.79
	Group 3	2.54	1.44	-0.29	0.99
Post (T2)	Group 1	2.94	1.18	0.10	0.94
	Group 2	2.92	1.26	0.09	1.00
	Group 3	2.43	1.31	-0.31	1.05
Change (T1-T2)	Group 1	0.98	0.96	0.74	0.85
	Group 2	-0.52	0.86	-0.59	0.76
	Group 3	0.11	0.96	-0.03	0.86

Note. Group 1 = Adhered, committed users with relatively large intervention gains. Group 2 = Less committed users with no intervention gains. Group 3 = Non-committed users with no intervention gains. *M* = mean, *SD* = standard deviation. Pre (T1) = pre-intervention. Post (T2) = post-intervention. Change in life satisfaction was calculated as T2-T1, where a positive result indicates an increase in life satisfaction. Change in stress was calculated as T1-T2, where a positive result indicates a decrease in stress.

Figure 1

Subgroups Based on Adherence, Usage Activity and Gains in Psychological Well-Being



Note. This figure demonstrates the standardized values for each measure used in cluster analysis (i.e., adherence percentage, completion percentage, usage time, usage weeks, change in life satisfaction, change in stress) for each of the three subgroups. Higher adherence was indicated by higher adherence percentage. Higher usage activity was indicated by higher completion percentage, usage minutes, and usage weeks. Change in life satisfaction was calculated as T2-T1 (T2 = post-intervention, T1 = pre-intervention), where a positive value indicates an increase in life satisfaction after intervention, a negative value indicates a decrease in life satisfaction, and a value of zero indicates no change. Change in stress was calculated as T1-T2 (T1 = pre-intervention, T2 = post-intervention), where a positive value indicates a decrease in stress after intervention, a negative value indicates an increase in stress, and a value of zero indicates no change.

III

A GUIDED ONLINE ACT INTERVENTION MAY INCREASE PSYCHOLOGICAL WELL-BEING AND SUPPORT SCHOOL ENGAGEMENT IN ADOLESCENTS

by

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A guided online ACT intervention may increase psychological well-being and support school engagement in adolescents

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ABSTRACT

Objective: The aim of the present study was to investigate the extent to which initial levels and changes in ninth-grade adolescents' (n = 243) psychological well-being were associated with their school engagement after the transition to upper secondary education. In addition, we investigated whether a brief guided online acceptance and commitment therapy (ACT) intervention program delivered during ninth grade was associated with adolescents' subsequent school engagement through changes in their psychological well-being.
Method: Latent growth modeling (LGM) was used to examine the levels of and changes in well-being during ninth grade. Next, school engagement (measured by school satisfaction and dropout intentions) at the first year of upper secondary education was added to the model as a distal outcome variable. Finally, we examined the indirect effects of an online ACT intervention on subsequent school engagement through changes in psychological well-being. Effects of gender and academic achievement were controlled for in all analyses.
Results: A higher level of life satisfaction at the beginning of ninth grade predicted higher engagement in upper secondary education, whereas increased depressive symptoms during ninth grade predicted lower engagement in upper secondary education. Also, participation in the brief guided online ACT intervention during ninth grade promoted school satisfaction through decreased depressive symptoms.
Conclusions: The results suggested that psychological well-being and changes in psychological well-being during the final year of basic education are associated with school engagement after the transition to upper secondary education. The results also suggested that a brief guided online ACT intervention may increase psychological well-being, which can, in turn, support later school engagement.

1. Introduction

Education stands as one of the most influential factors on career paths and other chances in life. People with a higher level of education tend to have better occupational prospects, higher earnings and likelihood of employment, longer life expectancy, and experience higher well-being (Brekke, 2014; Edgerton et al., 2012; Rumberger & Rotermund, 2012). According to the Organisation for Economic Co-operation and Development (OECD, 2021, 2022), around one in five upper secondary education students do not graduate. Explanations for high dropout rates include, but are not limited to, students' feelings of boredom or alienation, low academic achievement, and lack of motivation regarding schoolwork (Appleton et al., 2008; Fredricks, 2011; Fredricks et al., 2004). Research has turned towards the concept of school engagement in efforts to prevent dropout and support students' success in their educational goals.

School engagement (Appleton et al., 2008; Finn & Zimmer, 2012; Fredricks et al., 2004) is a multidimensional construct, commonly divided into emotional engagement (e.g., positive and negative reactions to teachers, peers, and academics, attitudes towards learning, sense of belonging), behavioral engagement (e.g., positive conduct, attendance, participation), and cognitive engagement (e.g., self-regulation, investment of effort, learning goals). Dropping out, in turn, is considered to be the result of a gradual process that involves experiences of disengagement from the academic and social facets of school life (Appleton et al., 2008). The present study examined school engagement in upper secondary education in terms of *school satisfaction* and *dropout intentions*, which can be considered to represent the emotional and behavioral dimensions of engagement. Higher school satisfaction is strongly associated with a range of social, behavioral and academic indicators of positive adjustment (Huebner & Gilman, 2006). In turn, having intentions to drop out predicts later actual dropout and

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has been associated with aspects of maladjustment and psychological ill-being (Garvik et al., 2014; Parviainen et al., 2020; Vasalampi et al., 2018).

Supporting school engagement also involves addressing student well-being. The global prevalence of common mental health disorders in adolescents is estimated to be around 25–31% (Silva et al., 2020). That is, at least one in every four adolescent experiences challenges in their psychological well-being, which can also reflect as challenges in school life. Psychological well-being was approached in the present study in terms of life satisfaction and depressive symptoms (Diener & Chan, 2011; Proctor et al., 2009).

1.1. The role of psychological well-being in school engagement and educational transition

According to self-determination theory (SDT; Deci & Ryan, 2000; Ryan & Deci, 2000), innate basic needs for autonomy, competence, and relatedness are at the center of psychological growth and motivation. SDT-based psychological needs have been shown to predict adolescent psychological well-being (Cordeiro et al., 2016) and to associate with school engagement (Hardré & Reeve, 2003; Tian et al., 2014). Across studies, adolescents' higher psychological well-being has been demonstrated to be associated with higher school engagement (Awang-Hashim et al., 2015; Heffner & Antaramian, 2016; Huebner & Gilman, 2006; Lewis et al., 2011; Rodríguez-Fernández et al., 2018; Yuen, 2016). Likewise, higher psychological ill-being has been connected to lower school engagement, namely, greater risk of dropout (Eicher et al., 2014; Garvik et al., 2014; Parviainen et al., 2020; Sagatun et al., 2014; Thorley, 2017). Psychological ill-being has also been recognized to predict risk of dropout after an educational transition (Duchesne et al., 2008; Mikkonen et al., 2021; Quiroga et al., 2013). However, less is known whether earlier occurring changes in psychological well-being play a role in predicting later school engagement.

1.2. Acceptance and commitment therapy in supporting well-being and school engagement

Acceptance and commitment therapy (ACT; Hayes et al., 1999; 2006) uses mindfulness-, value- and acceptance-based processes to increase psychological flexibility, which refers to the ability to be in contact with the present moment and the thoughts and feelings it produces, as well as to clarify personal values and act according to said values (Fletcher & Hayes, 2005; Hayes et al., 2006). ACT has received support in its feasibility of improving adolescent well-being and preventing and treating various mental health problems (Armstrong et al., 2013; Fang & Ding, 2020b; Harris & Samuel, 2020; Hayes & Ciarrochi, 2015). ACT has also been applied in the form of online intervention programs for adolescents (Lappalainen et al., 2021; Puolakanaho et al., 2019), adults (Brown et al., 2020; Lappalainen et al., 2013; Pots et al., 2016; Thompson et al., 2021), and parents of children with chronic conditions (Sairanen et al., 2020). ACT-based online intervention programs have been suggested to be as effective as ACT-based face-to-face interventions (Lappalainen et al., 2014; Ruiz, 2012).

The possibilities of ACT-based interventions in supporting school engagement have recently attracted attention in research. In two separate studies, Grégoire et al. (2016, 2018) found that university students who took part in an ACT-based workshop showed greater gains in their school engagement, psychological well-being, and psychological flexibility compared to the control group. Similarly, Fang and Ding (2020a) discovered that junior high school students who took part in an ACT intervention group experienced greater gains in their school engagement and psychological capital (i.e., self-efficacy, optimism, hope, resilience) compared to the control group. Katajavuori et al. (2021) reported an increase in university students' skills related to time and stress management, studying, and coping with negative thoughts after an online ACT-based intervention program. Kiuru et al. (2021) reported a decrease in adolescents' career-related insecurity after an online ACT-based intervention program.

Based on works by Fang and Ding (2020a) and Grégoire et al. (2018), it could be anticipated that changes in psychological processes could mediate the effects of ACT-based interventions on later school engagement. Previous studies on mediational processes regarding school engagement have shown that grade points (Sagatun et al., 2014) and self-perceived academic competence (Quiroga et al., 2013) have mediated the relationship between psychological well-being and school dropout. However, no previous studies have, to our knowledge, been conducted on mediational processes between online ACT intervention programs and subsequent school engagement through changes in psychological well-being.

1.3. The present study

The present study had two aims. The first aim was to investigate the extent to which psychological well-being and changes in psychological well-being during the ninth grade are associated with school engagement after the transition to upper secondary education. This was examined with levels of and changes in life satisfaction and depressive symptoms in relation to subsequent levels of school satisfaction and dropout intentions. The second aim was to investigate whether a brief guided online ACT intervention program delivered during the ninth grade (i.e., the final year of basic education) predicts adolescents' subsequent school engagement through their increased well-being. This was examined with direct and indirect associations from online ACT intervention to school engagement. The conceptual model illustrating the aims of the present study is presented in Fig. 1.

Hypothesis 1. It was anticipated that higher initial levels of well-being (i.e., higher life satisfaction and lower depressive symptoms) and increases in well-being (i.e., increased life satisfaction, decreased depressive symptoms) during the ninth grade would be linked to higher school engagement in upper secondary education (see also Awang-Hashim et al., 2015; Garvik et al., 2014; Lewis et al., 2011; Parviainen et al., 2020).

Hypothesis 2. It was anticipated that the investigated brief guided online ACT intervention program would predict higher school engagement (i.e., higher school satisfaction, lower dropout intentions) through increased well-being (i.e., increased life satisfaction, decreased depressive symptoms) (Fang & Ding, 2020a; Grégoire et al., 2018).

Academic achievement and gender were included as covariates in all models to control for their potential effects. Previous research has suggested academic achievement to be associated with psychological well-being (Lewis et al., 2011) and school engagement (Antaramian et al., 2010; Quiroga et al., 2013; Upadyaya & Salmela-Aro, 2017; Virtanen et al., 2016). Regarding gender, girls have been shown to express higher levels of school engagement and higher academic achievement, but also more depressive symptoms and lower levels of life satisfaction compared to boys (Lewis et al., 2011; Quiroga et al., 2013; Silva et al., 2020).

2. Method

2.1. Participants and procedure

The participants were recruited from a broader community sample consisting of around 800 students taking part in an ongoing longitudinal project carried out in 15 schools in two municipalities (population ~130,000) in Central Finland. Written consent was obtained from all participating adolescents and their parents. A subsample ($n = 249$) of students with equal number of girls and boys was selected for the randomized controlled trial of a five-week brief guided online ACT intervention program. The participants were randomized by an independent researcher to one of the following three groups: an intervention group with online support ($n = 82$), an intervention group with online support

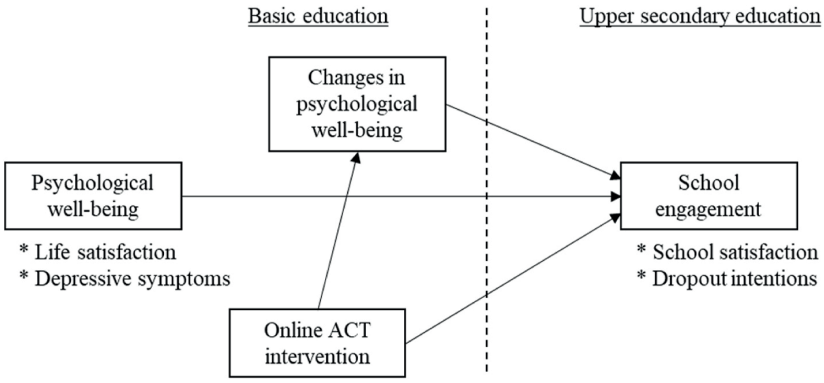

Fig. 1. A conceptual model illustrating the purpose of the present study.

and minimal face-to-face contact ($n = 83$), or the control group ($n = 84$) (see also Puolakanaho et al., 2019). Six adolescents did not take part in the first measurement (n = 80, 81, and 82 respectively). The present study analyzed the intervention groups as one whole group ($n = 161$), because differences in terms of intervention outcomes were non-significant between the forms of support (online support vs. online support and face-to-face meetings; Puolakanaho et al., 2019).

The participants were Finnish adolescents ($n = 243$, $M_{age} = 15.27$, $SD_{age} = 0.39$; see Table 1 for more detailed demographic information) who at the time of the online ACT intervention were at ninth grade. The intervention group took part in the intervention program during fall of 2017, at the beginning of ninth grade (see a more detailed description in the next section). Participants received a brief introduction and an instructions sheet with credentials and the program timetable. The control group received school counselling as usual and no intervention. Further details on randomization and the procedure are available in previous efficacy studies by Lappalainen et al. (2021) and Puolakanaho et al. (2019).

Table 1
Demographic information was gathered during early fall of ninth grade. Educational track was reported by participants in the fall of the first year of upper secondary education.

Characteristic	All participants ($n = 243$)	Intervention group ($n = 161$)	Control group ($n = 82$)
Age *M* (*SD*)	15.27 (0.39)	15.26 (0.32)	15.29 (0.50)
Gender *n* (%)	119 (48.97)	81 (50.31)	38 (46.34)
Girl	124 (51.03)	80 (49.69)	44 (53.66)
Boy			
Lives with *n* (%)	167 (68.72)	111 (68.94)	56 (68.29)
Mother and father	20 (8.23)	16 (9.94)	4 (4.88)
Mother or father	38 (15.64)	23 (14.29)	15 (18.29)
Alternately with mother and father	14 (5.76)	7 (4.35)	7 (8.54)
Other arrangement[a]			
GPA *M* (*SD*)[b]	7.90 (0.90)	7.88 (0.92)	7.96 (0.86)
Mother's education level *M* (*SD*)[c]	4.28 (1.31)	4.34 (1.31)	4.16 (1.30)
Father's education level *M* (*SD*)[c]	3.84 (1.47)	3.87 (1.50)	3.79 (1.42)
Educational track *n* (%)	119 (48.97)	75 (46.58)	44 (53.66)
General	100 (41.15)	72 (44.72)	28 (34.15)
Vocational	6 (2.47)	2 (1.24)	4 (4.88)
Other[d]			

Note. *M* = mean, *SD* = standard deviation.
[a] Participant lives with mother and stepfather, father and stepmother, in foster care, or in approved home.
[b] GPA on a scale from 4 to 10.
[c] Education level on scale of 1–7, where 1 = *no vocational training*, 7 = *post-graduate degree, i.e., licentiate, doctorate.*
[d] Participant takes part in pre-vocational preparatory education.

Participants' subjective well-being was measured twice, at early fall (September–October) of the ninth grade, before the five-week online ACT intervention (T1, $n = 243$) and at late fall (October–November) of ninth grade, after the intervention (T2, $n = 238$). The time gap between the pre- and post-measurements was seven weeks. Measurements for participants' school engagement were carried out in the fall of the following year, after the transition to upper secondary education (T3, $n = 197$). Measurements for subjective well-being and school engagement were carried out in group-form, that is, in class during school hours.

2.2. The intervention program

The five-week online ACT-based intervention program examined in the present study was called *Youth Compass*. The program is a web application that can be accessed via browser with a computer, tablet, or smartphone. The program consisted of five modules, one per intervention week. Each module was based on a different theme in ACT: (1) finding personal values and interests, (2) promoting self-awareness, skills of acceptance, and cognitive defusion, (3) being present, (4) self as context and self-compassion, and (5) applying important actions to one's social life and compassion toward others. The program contained short texts, audio clips, video clips, and comic strips, and was designed to fit adolescents by having short exercises and an interactive feel. Each module began with an introduction, which was followed by three consecutive sections that contained exercises. More information on intervention structure and content is available in previous efficacy studies by Lappalainen et al. (2021) and Puolakanaho et al. (2019) and more information on program usage and adherence is available in a previous study by Hämäläinen et al. (2022).

All exercises in Youth Compass were designed to take around two to five minutes each to complete, and most of them were in written and audio form. A module was marked complete when two mandatory exercises were completed in all three sections. A new module was accessible after completing the preceding sections. The participants were recommended to do the mandatory exercises, that is, six exercises per week (in total, 30 exercises during the five-week intervention period), which would mean investing around 15–30 min per week in the program. All modules also contained voluntary exercises, which the participants could do if they wanted. The participants used the intervention program outside school hours, during their leisure time.

All participants in the intervention group ($n = 161$) received support during the intervention from appointed personal coaches. The coaches were bachelor's and master's level psychology students, who had received training on the ACT approach prior to the intervention and had weekly access to a licensed psychologist's supervision during the intervention. Half of the intervention participants (n = 80) received online support from coaches in the form of instant text messages

(WhatsApp), and the other half (n = 81) received online support in addition to two face-to-face meetings with their coach (before and after the intervention).

2.3. Measures

2.3.1. Subjective well-being (T1 and T2, ninth grade)

Life satisfaction. Participants' life satisfaction was measured with the Finnish version of the Satisfaction with Life Scale (SWLS; Diener et al., 1985; see also Mauno et al., 2018; Pavot et al., 1991). The questionnaire consists of five items (e.g., "The circumstances in my life are excellent."), which are answered on a scale from 1 to 5 (1 = *completely disagree*, 5 = *completely agree*). The mean score of the scale's items reflects the level of life satisfaction, where a higher value indicates higher satisfaction (Cronbach's $\alpha = 0.90$).

Depressive symptoms. Participants assessed their mood using the Depression Scale (DEPS; Salokangas et al., 1995; see also Kiuru et al., 2012; Poutanen et al., 2010). The questionnaire consists of 10 items (e.g., "I feel that my future is hopeless."), which are answered on a four-point scale (0 = *not at all*, 3 = *very much*). The final score from the questionnaire can be from 0 to 30 points (Cronbach's $\alpha = 0.95$), where a higher score indicates more severe symptoms.

2.3.2. School engagement (T3, first year of upper secondary education)

School satisfaction. Participants rated on a scale from 1 to 5 their levels of satisfaction with their current place of education (e.g., "Are you satisfied with your current form of education?"; 1 = *not at all*, 5 = *very much*; see also Vasalampi et al., 2018). Mean scores over the four items are then calculated, where a higher value indicates higher school satisfaction (Cronbach's $\alpha = 0.90$).

Dropout intentions. Participants rated on a two-item scale their intentions to drop out from their current place of education ("Have you considered changing your school or field of study?", "Have you considered quitting your current school or field of study?"; 1 = *not at all*, 5 = *very often*; see also Parviainen et al., 2020; Vasalampi et al., 2018). Mean scores over the items are then calculated, where a higher value indicates higher intentions to drop out (Cronbach's $\alpha = 0.78$).

2.3.3. Intervention group

The intervention group variable was coded as follows: 0 = control group (n = 82) and 1 = intervention group (n = 123, i.e., those who fulfilled the adherence criterion, which was the completion of three or more out of five modules in the intervention program, see also (Lappalainen et al., 2021; Puolakanaho et al., 2019).

2.3.4. Covariates

Gender and academic achievement were used as covariates in the analyses.

Gender. Gender was coded as 1 = girl, 2 = boy.

Academic achievement. The participants self-evaluated their previous school report's grade point average (GPA). The commonly used grade range in the Finnish school system is from 4 (failure) to 10 (excellent), where 5 represents the lowest accepted grade for passing. Self-reported GPA has been shown to have a high correlation with actual grades from school registers (Sainio et al., 2019).

2.4. Statistical analyses

The research aims were addressed with the following analysis strategy. First, descriptive information was explored and initial levels and changes in psychological well-being in terms of life satisfaction and depressive symptoms during the ninth grade (i.e., from T1 to T2) were investigated through parallel latent growth modeling (LGM). Designs with two time points allow the changes between individuals as well as the direction and amount of change to be estimated (Duncan & Duncan, 2009). In LGM, the intercept factor refers to information concerning the collection of initial levels (intercepts) that characterize individuals, whereas the slope factor refers to information concerning the rate of change, that is, the slope of the straight line between the two time point measures (Duncan & Duncan, 2009; Preacher et al., 2008). In the present study, LGM were created for depressive symptoms and life satisfaction by fixing the loadings of the intercept factors to 1 and the loadings of the slope factors to 0 for T1 (i.e., early fall of ninth grade), and to 1 for T2 (i.e., late fall of ninth grade).

Second, the LGM was extended by including a new wave of assessment (T3) as the distal outcome variable, which in this study was school engagement (i.e., school satisfaction and dropout intentions). Participants' school satisfaction and dropout intentions in the fall of the first year of upper secondary education were predicted by both initial levels (intercepts) and changes (slopes) of life satisfaction and depressive symptoms during the fall of ninth grade (T1, T2). Adding a distal outcome variable to LGM allows examining the extent to which it can be predicted by the initial level or rate of change (Smid et al., 2020).

Third, the direct and indirect effects of online ACT intervention (0 = control group, 1 = intervention group) on school engagement through increased psychological well-being in our LGM were estimated (see also Cheong et al., 2003). Only the statistically significant associations were included in the final model. No direct effects were detected from online ACT intervention on school engagement, meaning that effects were mediated by changes in psychological well-being. Bootstrapping and 95% confidence intervals (CI) were used to assess the significance; effects are considered statistically significant when the 95% CI for the given estimates does not include zero (Preacher & Hayes, 2008). The CI was based on 1000 bootstrap resamples. Gender and academic achievement were controlled for by including them as covariates in all models.

All analyses in the present study were conducted using the Mplus software (Muthén & Muthén, 2017). Model fit was examined with a chi-square test (χ^2), the comparative fit index (CFI), and standardized root mean square residual (SRMR). A CFI value of around 0.95 or higher and an SRMR value of around 0.09 or lower show good model fit (Hooper et al., 2008; Hu & Bentler, 1999).

3. Results

3.1. LGM models for psychological well-being: associations with school satisfaction

Descriptive statistics and correlations of observed variables are presented in Table 2.

The estimation results regarding the final parallel LGM growth model for life satisfaction and depressive symptoms are presented in Table 3. The mean of the linear slope was significant for life satisfaction, indicating that on average adolescents' life satisfaction increased during the fall of ninth grade. In turn, the mean of the linear slope for depressive symptoms was not significant. The significant variances of both initial levels and linear slopes for life satisfaction and depressive symptoms showed further that there were statistically significant individual differences at initial levels as well as in the rates of change in both psychological well-being variables. Covariances between intercept and slope were significant and negative for both psychological well-being measures.

Our first research aim was to investigate the extent to which adolescent psychological well-being and changes in psychological well-being during ninth grade predict subsequent engagement in upper secondary education. This was done by adding school satisfaction and dropout intentions as distal outcome variables in the LGM by predicting them with initial levels and changes of life satisfaction and depressive symptoms. The results of the final LGM with distal outcomes including only statistically significant associations are shown in Fig. 2. The model fit the data well (χ^2 [4] = 2.66, p = .62; CFI = 1.00; SRMR = 0.01). The results showed that higher initial level of life satisfaction in ninth grade

Table 2
Descriptive statistics and correlations of observed variables.

Variable	*n*	*M*	*SD*	Min–Max	Range	1	2	3	4	5	6	7	8
1 Gender[a]	243	1.51	0.50	1–2	1	–							
2 GPA[b]	231	7.90	0.90	5.40–9.90	4.50	−.22***	–						
Depression													
3 T1	242	6.80	7.14	0–29	29	−.41***	−.09	–					
4 T2	237	6.50	6.88	0–30	30	−.31***	−.20**	.80***	–				
Life satisfaction													
5 T1	243	3.54	0.89	1–5	4	.25***	.22**	−.66***	−.63***	–			
6 T2	237	3.65	0.85	1.60–5	3.40	.20**	.23***	−.53***	−.63***	.78***	–		
School engagement													
7 School satisfaction	197	4.09	0.71	1.75–5	3.25	.02	.23**	−.06	−.19**	.26***	.29***	–	
8 Dropout intentions	197	1.93	1.07	1–5	4	.06	−.24***	.03	.18*	−.20**	−.23**	−.59***	–

Note. *$p < .05$; **$p < .01$; ***$p < .001$. *M* = mean; *SD* = standard deviation; T1 = early fall of ninth grade; T2 = late fall of ninth grade.
[a] Gender coded as 1 = girl, 2 = boy.
[b] GPA on a scale from 4 to 10.

Table 3
Growth factor parameter estimates for life satisfaction and depressive symptoms.

	Life satisfaction		Depression	
	Estimate	*SE*	Estimate	*SE*
Intercept				
Mean	3.54***	0.06	6.78***	0.46
Variance	0.79***	0.07	50.81***	4.62
Slope				
Mean	0.10**	0.04	−0.27	0.29
Variance	0.33***	0.03	19.46***	1.79
Covariance				
Intercept and slope	−0.20***	0.04	−11.60***	2.17

Note. **$p < .01$; ***$p < .001$. *SE* = standard error.

predicted higher satisfaction to upper secondary school and lower intentions to drop out. In addition, increased depressive symptoms in ninth grade predicted lower satisfaction to upper secondary school and higher intentions to drop out. Rate of change in life satisfaction and initial level of depressive symptoms did not significantly predict subsequent school engagement.

3.2. LGM models with indirect effects

Our second research aim was to examine the extent to which a brief online ACT intervention program promoted adolescents' school engagement in the first year of upper secondary education through changes in psychological well-being. This was done by investigating the direct and indirect associations in the LGM (the intervention group variable was coded as 0 = control group and 1 = intervention group). Only statistically significant effects were included in the final model. The fit indexes showed appropriate model fit (χ^2 [10] = 4.63, p = .91;

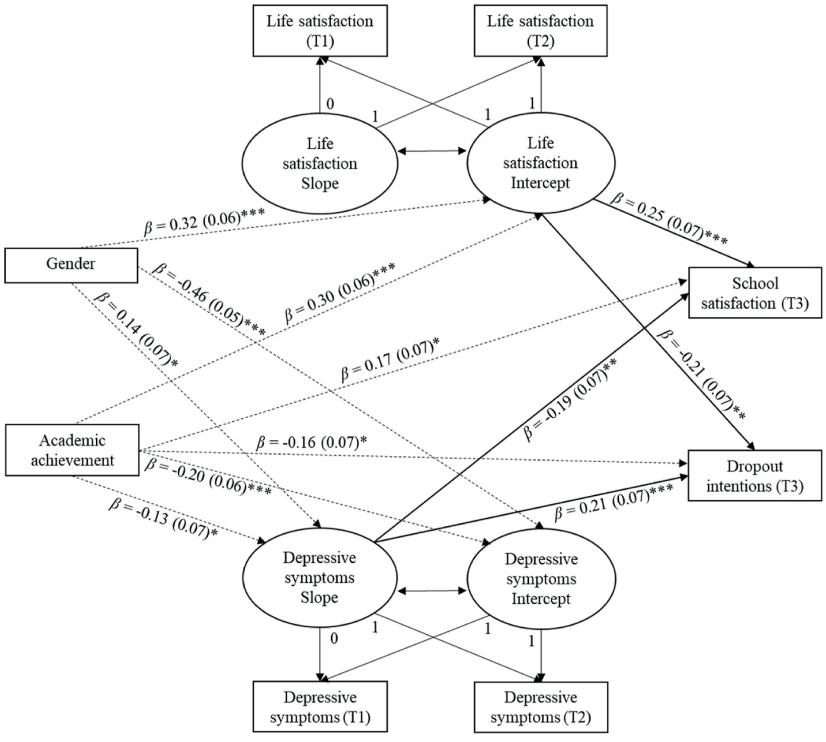

Fig. 2. Parallel latent growth model with statistically significant associations of psychological well-being measures (life satisfaction, depressive symptoms) with school engagement (school satisfaction, dropout intentions). Gender (coded as 1 = girl, 2 = boy) and academic achievement (GPA) were included in the model as covariates.
T1 = early fall of ninth grade; T2 = late fall of ninth grade; T3 = fall of first year of upper secondary education; β = standardized path coefficients (standard errors in parentheses).*$p < .05$; **$p < .01$; ***$p \leq .001$.

CFI = 1.00; SRMR = 0.03). The results regarding direct effects showed that the online ACT intervention significantly predicted an increase in life satisfaction (β = 0.15, *SE* = 0.06, 95% CI [0.016, 0.269]) and a decrease in depressive symptoms (β = −0.14, *SE* = 0.06, 95% CI [−0.256, −0.018]). Additionally, depressive symptoms were directly connected to school satisfaction (β = −0.22, *SE* = 0.09, 95% CI [−0.401, −0.040]) but not to dropout intentions. That is, decreased depressive symptoms during ninth grade predicted higher subsequent school satisfaction. No similar findings were detected for life satisfaction.

The results also revealed a significant indirect effect from online ACT on subsequent school satisfaction through changes in depressive symptoms (β = 0.03, *SE* = 0.02, 95% CI [0.001, 0.078]). That is, participating in the online ACT intervention program in ninth grade predicted a decrease in depressive symptoms, which further predicted higher school satisfaction after the transition to upper secondary school. By contrast, direct effects from online ACT on subsequent school engagement were not significant ($p > .05$), suggesting that the effect of online ACT intervention on subsequent school satisfaction was fully mediated through changes in depressive symptoms. The previous literature has noted that a significant direct effect from the independent variable on the dependent variable is not necessary for the occurrence of a significant indirect effect (Preacher & Hayes, 2008; Zhao et al., 2010).

4. Discussion

The present study examined the extent to which levels of and changes in psychological well-being during the final year of basic education were associated with later school engagement. Additionally, we investigated if increased psychological well-being during ninth grade mediated the effects of an online ACT intervention program on later school engagement. The effects of gender and academic achievement were controlled for in all analyses. The results suggested that level of life satisfaction and changes in depressive symptoms during ninth grade were connected to later school engagement. One significant indirect effect was also detected from online ACT on school satisfaction through changes in depressive symptoms.

Regarding the first research aim, the results showed that higher school engagement at the upper secondary level was associated with adolescents' higher initial life satisfaction in ninth grade. Adolescents who experienced an increase in depressive symptoms during ninth grade were more likely to have lower school engagement at the upper secondary level. The results partly supported the first hypothesis and seem to fall in line with previous studies on the relationship between higher well-being and higher school engagement (Awang-Hashim et al., 2015; Heffner & Antaramian, 2016; Yuen, 2016), as well as lower well-being and lower school engagement (Garvik et al., 2014; Parviainen et al., 2020; Sagatun et al., 2014). On one hand, it was unexpected that a change in life satisfaction and initial level of depressive symptoms would show non-significant associations with school engagement. On the other hand, one explanation for the results could be that different aspects of and processes in well-being may be differently connected to school engagement. Global life satisfaction is considered to be relatively stable and not as prone to sudden changes as mood-related scales (Eid & Diener, 2004). The present results can be seen to offer new information regarding the complexity of the relationship between psychological well-being and school engagement. Continuing to examine well-being and changes in well-being is encouraged in future studies to allow for further comparisons.

Regarding the second research aim, the results showed that the effect of online ACT intervention on higher school satisfaction (but not on dropout intentions) was mediated by decreasing depressive symptoms, thus providing support for the second hypothesis. The results seem to be in line with previous notions that ACT-based interventions may promote students' well-being and encourage them to take action towards building a more meaningful life, which can also be reflected in their commitment to educational goals (Fang & Ding, 2020a; Grégoire et al., 2018). In turn, contrary to the second hypothesis, no significant indirect effects were detected from online ACT on school engagement through life satisfaction. It seems possible that different aspects of psychological well-being react differently to online ACT interventions, which can produce different results in terms of mediation as well.

4.1. Limitations and future proposals

This study has several limitations. First, the present study used LGM with two time points to investigate adolescent psychological well-being, which allows the individual changes and direction of changes to be estimated, but not the trajectories (Duncan & Duncan, 2009). Future studies utilizing longitudinal designs could offer a deeper understanding on the individual trajectories of psychological well-being and their associations with school engagement or trajectories of school engagement over time.

Second, attention should be drawn to the sample and how participants' characteristics were assessed. The present study used a non-clinical sample of Finnish adolescents, which encourages future research to be conducted with new samples, including other age groups and ethnic groups and clinical samples. In the present study, gender was addressed with binary coding. Taking gender diversity into account may reveal important knowledge on the possibly unique experiences relating to school life and well-being (Johnson et al., 2020; Perry et al., 2018). Hence, future studies should include the possibility of reporting also non-binary gender identities.

Third, taking into account the bidirectional relationships between well-being and school engagement (Lewis et al., 2011) would be beneficial in the future. Important additional information could presumably be obtained by also using other indicators of psychological well-being, such as ACT-based process measures (see also Grégoire et al., 2016, 2018; Liinamaa et al., 2022; Sairanen et al., 2020). In addition, adjusting for possible externalizing symptoms could offer a fuller view on the association between internalizing symptoms and school engagement (Melkevik et al., 2016).

Fourth, the school engagement measures used in the present study reflected emotional and behavioral dimensions of engagement, but did not include the cognitive dimension (see also Fredricks, 2011). In future research, using measures that represent all dimensions of school engagement could also provide deeper understanding on their associations with psychological well-being and changes in well-being. One way of integrating cognitive engagement could be by including measures related to academic aspirations, goals, or goal progress (Lewis et al., 2011; Vasalampi et al., 2018). Another point to consider is that the present study examined dropout intentions, but no information was available on actual dropout. Among the students having dropout intentions, some continue their studies and graduate, some switch schools and eventually graduate, and some drop out before graduating. It seems possible that a closer comparison between students having dropout intentions and different dropout outcomes could show different associations with psychological well-being as well.

4.2. Conclusions

Our results suggested that adolescent mental health plays a role in the transition and adjustment to upper secondary education. The results supported previous research regarding the connection between higher psychological well-being and higher school engagement. New viewpoints were also discovered, as it was found in the present study that changes in well-being, here represented by decreased depressive symptoms, were associated with higher school engagement. In addition, the present study showed that an online ACT intervention program delivered during ninth grade can promote adolescent well-being, which can, in turn, promote later engagement in upper secondary education. We propose that supporting adolescent psychological well-being plays an important role in efforts to promote school engagement and prevent

dropout from upper secondary education. With some caution, we suggest that online ACT-based intervention programs may be one method for providing this support.

Ethical approval

This study was conducted in compliance with APA ethical standards and with the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. The study has been approved by the Ethical Committee of the University of Jyväskylä and has been registered at ClinicalTrials.gov (NCT03274934).

Informed consent

Informed consent was obtained from all participants of the study.

Data sharing and declaration

The datasets generated and/or analyzed in this study are not publicly available but are available from the corresponding author on a reasonable request.

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Declaration of competing interest

The authors declare that they have no conflict of interest. Given his role as an Editorial Board Member, Dr. Raimo Lappalainen had no involvement in the peer-review of this article and had no access to information regarding its peer-review.

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