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Acceptability and feasibility of a gamified digital eating disorder early-intervention program (*AcceptME*) based on Acceptance and Commitment Therapy (ACT)

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ABSTRACT

Background: Digital early-intervention programs for a variety of psychological conditions, including eating disorders (EDs) are increasing. Yet, none to date have leveraged gamification and vicarious learning components grounded in empirically-supported therapeutic approaches to engage young people at risk for developing EDs in behaviour change.

Purpose: The current paper describes the development and preliminary acceptability and feasibility testing of *AcceptME,* a novel self-directed, gamified digital ED early-intervention program based on Acceptance and Commitment Therapy (ACT). *AcceptME* helps women and girls identified at risk for an ED relate differently to their thoughts and feelings, such that these experiences do not have undue influence over their behaviour and actions can instead be guided by personal values.

Methods: Users learned skills of psychological flexibility by helping a third-person avatar (a main character in a storyline) navigate situations that elicit distressing thoughts/feelings, and via interactive exercises, practiced applying these skills to their own experiences. Young women and girls in the Republic of Cyprus with high weight concern scores (N = 58, Mage = *15.27, SD = 2.25*) completed six 30-min digital sessions and reported on session and intervention acceptability.

Results: Attrition was 46.55%. Of those who completed treatment, the majority of participants were either "Very" (40%) or "Mostly" (57%) Satisfied with the program. Fifty-two percent reported that the program "Helped a lot," and 48% said it "Helped a bit." **Conclusion**: Digital technology and gamification have advantages for engagement and delivery. The current study suggests a promising direction for early ED interventions to reach at risk youth and preliminary data to guide development.

Eating Disorders (EDs) result in numerous physical and psychological adverse consequences for a suffering individual and their family. Yet, population-based studies of EDs indicate that only 20% of adolescents seek treatment and mostly seek treatment once they are severely impaired (Forrest et al., 2017). The infrequent treatment seeking from adolescents is associated with feelings of shame and stigma, concern for others, self -sufficiency, fear of losing control (Ali et al., 2017), and failure to perceive the severity of the illness (Forrest et al., 2017). Digital intervention programs may help overcome such barriers-to-treatment as they provide intervention in a safe environment and can be anonymous, thus circumventing fears of disclosure or being judged (Newton & Ciliska, 2006). As digital interventions can minimize feelings of exposure and shame, it may be easier to engage and complete exercises, explore and express difficult thoughts and feelings (e.g., body dissatisfaction), and consider behaviour change (Newton & Ciliska, 2006). Such programs also remove geographical constraints, allowing individuals even from remote locations to get support, and can be available 24 h a day and 7 days per week (Karekla & Savvides, 2021).

As youth are especially attracted to digital and smartphone multimedia applications, there is a growing recognition that digital gamification risk-factor reducing, prevention and early-intervention programs may be the preferred delivery method to reach this age group (Kahn et al., 2013). Gamification is the integration of game design elements (such as animations, videos and point reward systems for exercise and

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game completion) into prevention and intervention programs (Deterding et al., 2011). Many gamification features are grounded in behaviour change theory and utilize operant learning principles with demonstrated behaviour change effectiveness (e.g., reinforcement; Deterding et al., 2011). Gamification also includes the use of a storyline (Lieberman, 2006), which involves a compelling narrative with clear rules, challenging and achievable goals. Storytelling is an established method to purposefully learn from another's experiential knowledge (Anderson et al., 2018) and is perceived as pleasurable (Mayes et al., 2001). It can provide the opportunity to observe the intervention skills and techniques in practice, rather than receiving didactic instruction or just reading "dry facts" (Negrete & Lartigue, 2004) and it can engage the person more deeply and experientially, with the possibility of greater long-term learning impact (Karekla et al., 2019). In addition, vicariously learning through storytelling can help improve understanding of difficult-to-grasp therapeutic concepts (Pappas, 2015), and provide relatable, real-life examples of skill use that may be imitated in the future. The perspective from which a desired behaviour is observed can be significant in determining whether individuals are motivated to consequently execute that behaviour themselves (Rennie et al., 2016). Visualizing a task from a third-person perspective can result in more abstract understanding which leads to perceiving the behaviour as more important (Rennie et al., 2016) and motivates health behaviour changes (Hagger et al., 2011).

Preliminary evidence suggests that gamification can improve participants' health behaviours in areas such as addiction, healthy eating, physical activity, physical therapy, smoking cessation, cancer treatment adherence and self-management of asthma and diabetes (Johnson et al., 2016; Karekla et al., 2019). However, the application of gamification components for behaviour change is still in its infancy (Karekla et al., 2019). To date, ED prevention and early-intervention programs have not utilized gamification, storyline and vicarious learning principles to engage young people at risk for an ED and facilitate behaviour change. Digital interventions that include gamification are more effective if they are developed based on a sound psychological theory of change, yet many such programs are not grounded in evidence-based psychological theories of change creating a dissonance problem (Karekla et al., 2019; Loucas et al., 2014).

Existing ED prevention and early-intervention programs have aimed to decrease ED risk by either reducing the pursuit of the thin ideal (Stice et al., 2013, 2019) or on disputing and replacing unrealistic thoughts with regard to food, body and weight (Vanderlinden, 2008). This approach, based on traditional cognitive-behavioural therapy (CBT), has been helpful, but effects are modest, and Stice and other experts have called for additional ED prevention and early-intervention programs targeting other mechanisms of ED development (Stice et al., 2019). Contemporary CBTs (such as Acceptance and Commitment Therapy; ACT; Hayes et al., 2011) offer an alternative approach, targeting the function of ED symptoms, rather than their topographical form. Extensive evidence exists suggesting that ED symptomatology and control of emotional states either by avoiding or inhibiting emotional responses (Cockell et al., 2004; Heatherton & Baumeister, 1991; Koushiou et al., 2018; Merwin et al., 2011, 2013). Changing how individuals relate or respond to internal experiences, and decoupling the functional relationship between these internal experiences and maladaptive control behaviors (Levin et al., 2015) may apply across time and situations, and allow for more immediate and long-lasting behaviour change (Juarascio et al., 2013; Merwin & Wilson, 2009).

Acceptance and Commitment Therapy (ACT; Hayes et al., 1999) is a functional-contextualistic CBT that explicitly targets experiential avoidance and control strategies that underlie a range of psychological problems. According to ACT, the content of internal experiences is mainly outside voluntary control and therapy should focus on teaching patients to become more accepting of unwanted internal thoughts and feelings (Hayes et al., 2011). ACT interventions allow individuals to have internal experiences (including distressing thoughts and feelings about the body) while pursuing personal meaningful values (Sandoz et al., 2013). The aim is for behaviour to be less unduly influenced by these experiences and more flexible and effective; matched to the individual's ongoing and dynamic needs (e.g., signals of hunger/satiety, emotions; Merwin et al., 2011). Thus, individuals may have negative thoughts and feelings about the body, or feelings of anxiety and guilt, and still treat their body well (e.g., eating to hunger/satiety, not purging or engaging in other maladaptive weight control strategies) if doing so aligns with their personal values (Ferreira et al., 2011; Manlick et al., 2013; Pellizzer et al., 2018; Rogers et al., 2018). Individuals vulnerable to an ED develop increasing preoccupation with body shape and weight and control over eating (Fairburn et al., 2013), often losing sight of other things that are important to them, and contributing to ambivalent feelings towards engaging into treatment. A risk-factor reduction (i.e., targeting body dissatisfaction) early-intervention program based on ACT has the potential to assist high risk individuals by clarifying personal values in other life domains and facilitating a desire to change. ACT holds potential in improving outcomes in ED treatment (e.g., (Juarascio et al., 2013; Merwin et al., 2019, 2013; Timko et al., 2015; Wildes & Marcus, 2011)), but has not previously been leveraged to prevent further progression to an ED.

This paper introduces the *AcceptME* program, a gamified digital early-intervention based on ACT, where females at-risk for developing an ED learn how to alter their relationship to thoughts/feelings about eating and body weight and shape concerns and align behaviour with personal values. This is the first study to apply an ACT-based risk-reduction early-intervention program for ED, delivered digitally and utilizing gamification principles. Further, this is the first program to utilize a third-person perspective, employing social learning principles (Bandura, 1965; 2001) as a way to learn vicariously from the game characters' experience, helping that character deal with their difficulties, which in turn is hypothesized to encourage behaviour change in the person themselves (Lieberman, 2006). Individuals with EDs tend to be more interpersonally sensitive and follow social models or scripts to gain acceptance from peers, thus the utilization of social learning principles may be well suited. The aim of this study is to describe the development of the *AcceptME* program, report on its feasibility and acceptability, and summarize participants' feedback to identify the most useful components of this approach. Understanding participant views is believed to enable program developers to examine satisfaction, acceptability, feasibility and address barriers to engagement in future iterations of the specific program (Bradbury et al., 2019; Hemmings et al., 2021).

1. Methods

1.1. Participants

Participants were recruited from twenty-five public high schools and the University of **XXX.** Over 1000 young women were screened: 750 high-school students and 300 university students, aged 13–25 years ($M = 16.80$ years, $SD = 2.80$). A total of 62 individuals were enrolled in the *AcceptME* group ($M_{age} = 15.27$ years, $SD = 2.26$). The majority of the sample (98%) were Greek-Cypriot; 1% were Turkish-Cypriot, and 1% Maronite. To be included in the study, individuals had to be females aged 13–25 years, voluntarily agree to participate (providing informed consent and with parental consent if under 18 years old), have good working knowledge of the Greek language and score 52 or greater on the Weight Concern Scale (WCS; Killen et al., 1996) indicating early signs of an ED and high risk for developing full-threshold ED within 4 years (Killen et al., 1996). Individuals were excluded if they were identified as possibly having an ED diagnosis based on their Eating Diagnostic Scale score.

1.2. Procedure

The screening questionnaire was administered, either manually or via online computer-based administration (using SurveyMonkeyAudience, www.surveymonkey.com/mp/audience) during class time and supervised by project researchers (N = 1050). Students who met criteria for participation (and their parents if < 18 years of age; n = 292) were contacted via telephone to be invited to participate in the early-intervention program. Screening included the Eating Disorder Diagnostic Scale (EDDS) and students who were identified as having a possible ED diagnosis were referred to the Centre of Prevention and Treatment of Eating Disorders- Children and Adolescents Mental Health Services (only clinic in the country offering these services). One-hundred-and-four individuals presented with a possible eating disorder diagnosis on the EDDS, were excluded and referred for further evaluation. The rest were invited to take part in the study and of those 92 agreed to participate and of those, 62 were randomly assigned to the *AcceptME* program (the rest 30 individuals were placed in a wait-list control group and will not be discussed in this study). These individuals were sent a text message with webpage link, username, and password. *AcceptME* participants completed assessments at baseline, after each session, end-of-intervention (immediately after completing Session 6) and at 1-month follow-up. Fifty-eight individuals entered and completed pre-intervention measures and session 1, 41 completed session 2, 37 completed session 3, 33 completed session 4, 32 completed session 5 and 31 completed session 6.

1.3. Digital protocol and software development

A website was developed to host the program. The software development used PHP (php.net) and Jquery (jquery.com). The Backend code was developed in Symphony (symphony.com). Graphics were created using "Gif animations". Character voices were recorded using "garage band" application. The research and development team consisted of two clinical psychologists with experience in working with EDs, a computer science graphics specialist and an engineer/social gaming expert. Four design iterations were conducted to design and develop the program. For the character designs, six representative adolescent and young adult females were included to express opinions regarding the character looks (body shape types), the overall program feel (realistic feel in accordance to the storyline) and the color schemes used. Final designs were approved by the research and development team.

The digital early-intervention program consisted of 6 sessions and each session had to be completed within the same day it was began. Sessions were consecutive and participants had to complete them in order. Between sessions, participants received one text message three days after their last login inviting them to complete the next session.

The storyline (narrative) chosen for the early-intervention program was a story of a young girl contemplating whether to enter a reality television fashion contest. The participant followed the main character through the storyline as she made the decision to enter the contest and faced situations that elicited difficult thoughts and emotions, generally and specifically related to her body. A third person perspective was used, where the participant viewed the events unfolding from the perspective of an observer. The participants were encouraged to assist the leading character in progressing in the game by completing exercises that taught ACT skills (e.g., acceptance, defusion, present moment awareness) to cope with distressing thoughts/feelings. Participants' responses to various exercises were integrated into later conversations between the leading character and other characters in the "game," providing some tailoring of the storyline to help the participant identify with the leading character and her challenges. The participant was also asked to help the character overcome some difficulties, for example by providing advice on how to handle difficult situations or by giving suggestions on what

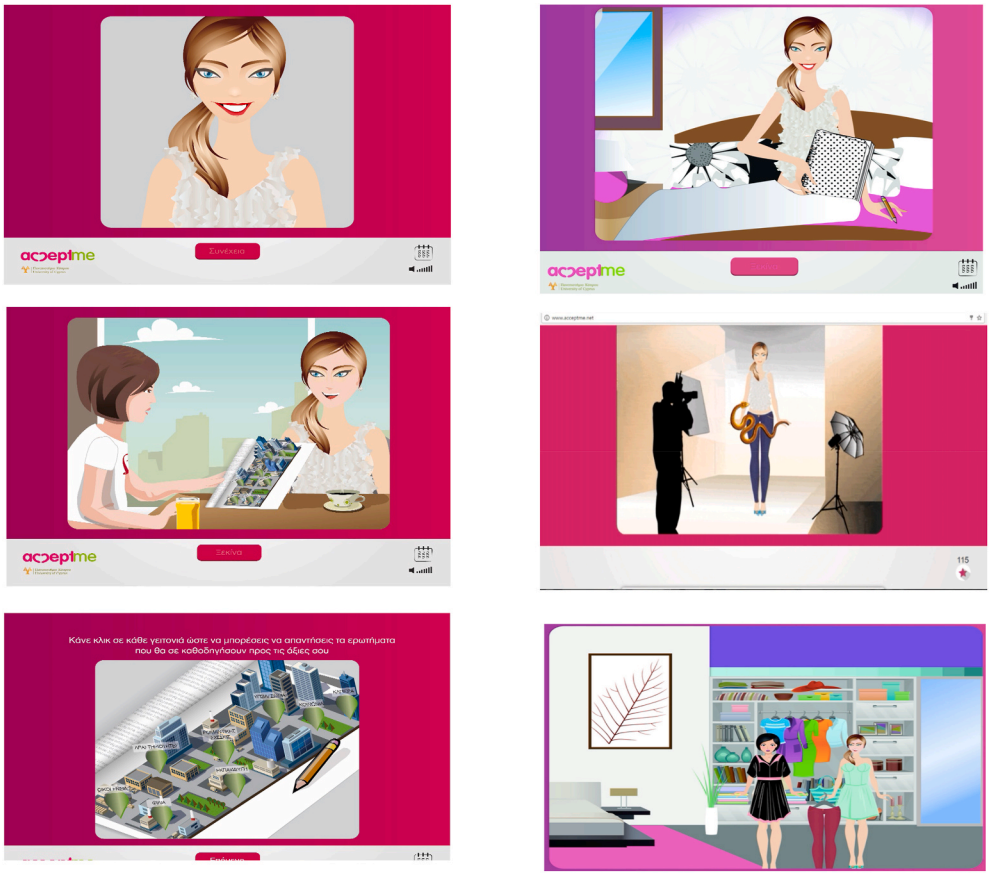

Fig. 1. Pictures from the *AcceptME* program. (1) Main character, avatar; (2) A scene from session one; (3) Values exercise-Building a values-living map; (4) End of each session-Session recap-avatar reciting her learning and achievements in her diary; (5) Illustration of a facing ones' fear exercise; (6) Illustration of avatar receiving rewards (new clothes) for achievements in the program.
Fig. 1. Pictures from the *AcceptME* program. In order from the top: (1) Main character, avatar; (2) A scene from session one; (3) Values exercise-Building a values-living map; (4) End of each session-Session recap-avatar reciting her learning and achievements in her diary; (5) Illustration of a facing ones' fear exercise; (6) Illustration of avatar receiving rewards (new clothes) for achievements in the program.

ACT skills to use to manage a specific problem or difficulty later in the program. By asking the participant to help the character achieve her goals, the aim was for participants to gain new skills that could be applied to their own life **(see XXX (masked for blind review)** for a video run-through of sessions and Fig. 1 for pictures from the program).

Each of the six sessions included ACT experiential exercises and metaphors to teach core skills. The choice of experiential exercises and metaphors were based on ease of adaptation to an interactive, digital format (without a face-to-face encounter) and integration into the storyline; and fit to the target population (i.e., developmentally appropriate and well-matched to young women). Additional gamification components included awarding of points upon completion of sessions, exercises and homework; animations, videos, and interactive exercises.

The early-intervention program protocol borrowed from different ACT resources, manuals and self-help books for ED (Ciarrochi, Joseph, Hayes, Louise, & Bailey, 2012; Heffner et al., 2002; Lillis et al., 2014; Pearson et al., 2012) and previous ACT-based digital interventions (Karekla et al., 2021; Karekla & Savvides, 2021). Sessions were approximately 30 min in duration. Table 1 outlines session content, goals and interventions.

1.4. Measures

Participants completed a demographics questionnaire (e.g., age, nationality, year in school), as well as the EDDS and the WCS at baseline. They completed measures of acceptability at the end of each session and program satisfaction at the end of the study (1-month follow up). Additional measures were administered at baseline, end-of-treatment and 1-month follow-up; however, these measures are not included in the current manuscript which focuses on program acceptability and feasibility.

The *Eating Disorder Diagnostic Scale* (EDDS; Stice, Telh & Rivzi, 2000) is a 22-item self-report scale of ED symptoms. The diagnostic items are summed forming an overall composite indicating ED symptom severity. The EDDS has shown high agreement with diagnoses made with the Eating Disorder Examination (EDE) and is used to identify individuals meeting ED diagnosis criteria. The scale was found to have high test-retest reliability *(r* = 0.87*,* Karekla & Savvides, 2021) and adequate reliability in the present study *(Cronbach's alpha = .62)*.

The *Weight Concerns Scale* (WCS; Killen et al., 1996) consists of 5 questions assessing fear of weight gain, worry about weight and body shape, importance of weight, diet history, and perceived fatness. The WCS (scores above 52) is found to identify individuals at risk for the later development (within the next 4 years) of disordered eating (Killen et al., 1996; Silva et al., 2017). Graham et al. (2019) examined the sensitivity and specificity of WCS cut-off scores related to ED diagnosis and suggested that for identifying individuals at high-risk for general prevention or early intervention programs, scores >47 presented with adequate sensitivity without sacrificing specificity and scores >51 were reported to have greater than 0.80 sensitivity and specificity. Previous studies (Killen et al., 1996; Silva et al., 2017) reported satisfactory internal consistency (*Cronbach's alpha* >.70) and in the present study *Cronbach's alpha = .76*.

1.5. Acceptability and feasibility measures

End-of-Session Questionnaire. At the end of every session, participants completed a questionnaire assessing satisfaction and perceived usefulness of each treatment session and its interventions, including whether the session was helpful in meeting its stated goals, and which aspects participants found the most or least useful (more than one choice was allowed). Items were rated on a Likert scale ranging from 0 = Not at all helpful to 10 = Extremely helpful.

The *Program Satisfaction Questionnaire* (PSQ; adapted from Gulec et al., 2011; see Supplementary materials) was administered at end of study participation. Items were added or adapted to match the *AcceptME*

Table 1
Sessions content, goals, intervention components presented and perceived helpfulness.

Session 1 (***n* = 58**)	
Description: Introduced the characters and storyline, and presented an overview of the program.	
Primary Goals	***How helpful was this session in …*** 0 (Not at all)-10 (Extremely) Scale
Discovering how our body-related thoughts affect our life	*M = 7.94, SD = 1.45*
Clarifying our values in life[b]	*M = 8.30, SD = 1.33*
Intervention components presented	***Which activity was most helpful? Which activity was NOT helpful?***[a] *N* Identifying as "Most Helpful"/"Not helpful", % of active participants identifying as helpful
The question: *How would your life be different if you did not allow negative thoughts about your body to guide you?*	45/10, 94%
The question: *How different would your life be if you were not constantly on a diet? What would you spend your energy on?*	30/30, 63%
Values-Game of Life[c]	30/0, 63%
Life Map exercise[d]	39/0, 81%
Session 2 (***n* = 41**)	
Description: Aimed to undermine experiential avoidance via experiencing ones' own struggle with thoughts/feelings (adapted from Pearson et al., 2012; Lillis et al., 2014) and identifying control/avoidance strategies used to manage distressing thoughts and feelings, and examining the workability of these strategies. Ineffectiveness of changing internal experiences by changing something external (e.g., body weight and shape) was demonstrated (Pearson et al., 2012) and the concept of cognitive defusion as an alternative was introduced.	
Primary Goals	***How helpful was this session in …*** 0 (Not at all)-10 (Extremely) Scale
Discovering the behaviours you engage in, in order to change thoughts and feelings about your body	*M = 6.94, SD = 1.78*
Discovering that the control/avoidant behaviours are not helpful in the long-run	*M = 6.69, SD = 1.95*
Intervention components presented	***Which activity was most helpful? Which activity was NOT helpful?***[a] *N* Identifying as "Most Helpful"/"Not helpful", % of active participants identifying as helpful
Avatar discussions regarding control/avoidant behaviours and *chocolate cake metaphor*[e]	11/6, 27%
Discussion of avatar with other characters about worrisome body-related thoughts & feeling (demonstrating fusion with thoughts)	11/3, 27%
Writing a list of all the things you have tried to make your thoughts and feeling change or go away	12/1, 29%
Open-ended question exercise to connect with personal struggle with thoughts and feelings[f]	10/2, 24%
Distancing exercise[g]	10/6, 24%
Discussion of avatar with other characters about the ABCs of behaviour (Antecedents, Behaviour, Consequences)	9/6, 22%
Ball in the pool metaphor[h]	8/6, 20%
Session 3 (***n* = 37**)	
Description: This session focused on identifying additional experiential avoidance behaviors related to difficult thoughts and to introduce willingness and acceptance as alternatives to control. Mindfulness is presented as a technique to help become more aware of thoughts and emotions in the present.	
Primary Goals	***How helpful was this session in …*** 0 (Not at all)-10 (Extremely) Scale
Learning to recognize feelings	*M = 8.17, SD = 1.42*
Learning acceptance and mindfulness	*M = 8.06, SD = 1.50*
Intervention components presented	***Which activity was most helpful? Which activity was NOT helpful?***[a] *N* Identifying as "Most Helpful"/"Not

(*continued on next page*)

Table 1 (*continued*)

Session 1 (**n = 58**)	
Description: Introduced the characters and storyline, and presented an overview of the program.	
	helpful", % of active participants identifying as helpful
Exercise to identify different emotions and open-ended questions for emotional awareness and identification of control/ avoidance behaviours related to each emotional state.	16/13, 43%
Rip Current Metaphor[j]	21/9, 57%
Tug of War with a Monster metaphor[j]	19/15, 51%
Mindfulness training	21/9, 57%
Exposure exercise- facing fears	20/13, 54%
Helping Selena (main character) with her fears- practicing mindfulness and acceptance skills	20/13, 54%
Session 4 (**n = 33**)	
Description: This session aimed at identifying additional behaviours used to manage difficult thoughts and to elaborate on cognitive defusion. It also made a distinction between observing vs. thinking-self.	
Primary Goals	***How helpful was this session in …*** 0 (Not at all)-10 (Extremely) Scale
Helpful in discovering their body related thoughts/judgments	*M = 7.87, SD = 1.87*
Learning techniques to get unstuck from their thoughts	*M = 8.06, SD = 1.63*
Intervention components presented	***Which activity was most helpful? Which activity was NOT helpful?***[a] *N* Identifying as "Most Helpful"/"Not helpful", % of active participants identifying as helpful
Mindfulness *Mirror exposure exercise* [k]	17/9, 52%
Thought defusion *Musical thoughts exercise*[l]	19/9, 58%
Thought defusion *Cartoon voice exercise*[m]	16/5, 48%
Thought parade exercise[n]	16/12, 48%
Mind as a trash can metaphor[o]	17/12, 52%
Avatar encouraging the participant to engage in the *Mirror exposure* and cognitive defusion exercises presented in this session	14/2, 42%
Session 5 (**n = 32**)	
Description: The goal of this session was to further clarify values in regards to relationships and integrate techniques learned in previous sessions to manage a difficult emotional situation. This session aimed to assist with generalization of skills learned to other life situations.	
Primary Goals	***How helpful was this session in …*** 0 (Not at all)-10 (Extremely) Scale
Clarifying relationship values	*M = 8.68, SD = 1.68*
Intervention components presented	***Which activity was most helpful? Which activity was NOT helpful?***[a] *N* Identifying as "Most Helpful"/"Not helpful", % of active participants identifying as helpful
Discussion & questions clarifying relationship values[p]	26/7, 81%
Avatar encouraging the participant to engage in an exercise exploring how they would like to act in relationships[p]	23/7, 72%
Session 6 (**n = 31**)	
Description: This session focused on termination and continued practice following the end of the gamified intervention. It integrated the importance of willingness to experience thoughts and feelings, highlighting choices in the present moment and pivoting towards choosing to act in accordance to ones' values. The game ended with a summary and review of all skills learned in this program.	
Primary Goals	***How helpful was this session in …*** 0 (Not at all)-10 (Extremely) Scale
Evaluation of values-based living	*M = 8.58, SD = 1.66*
Intervention components presented	
Demons in the purse metaphor[q]	
Revisiting the *Life map* created in session 1 and planning for values-based behaviors for the future (committed action)	
Open-ended questions[r] for goal setting, identifying obstacles and planning for utilizing skills learned to overcome barriers to values-based actions	

Note.

**For session 6, participants were not asked to which components they found most helpful as session 6 comprised mostly of reviewing and summarizing previously presented concepts.

[a] More than one choice was allowed.

[b] Values clarification (Hayes et al., 2011): Involves first clarification of deeply meaningful chosen values as opposed to confusion about what is meaningful for the person, and secondly living life congruently to what is really important for the person (i.e., behaving in accordance to one's values).

[c] *Values-Game of life*: This is a game adapted and digitized originally from Hayes & Ciarrochi (2015) (see also, Karekla et al., 2020). It involves playing a game where the person first chooses 5 numbers randomly from 0 to 60 and then being informed that these numbers correspond to how their life would unfold. Participants are asked to consider whether this is indeed how they would like their life be and proceed with making their values choices from a table of 60 values statements about how they would like their life to be about. In this program, the avatar is playing the game with the help of the participant.

[d] *Life Map exercise:* This exercise follows the values clarification Game of life and participants are asked to design for themselves a map of how they would like their life to be (see Fig. 1, panels 2 & 3). This map looks like a city map with different neighborhoods each representing different values areas based on choices made above. In this program, the avatar creates this map with the help of the participant thus reflects the participant choices.

[e] *Chocolate cake metaphor* (Hayes et al., 1999): This metaphor demonstrates the inevitability of control of thoughts and the thought suppression paradox. It involves asking the person to not think about a chocolate cake whilst the presenting avatar describes a cake in detail.

[f] Exercise to identify personal struggle with control and avoidance of thought and emotion strategies (adapted from Pearson et al., 2012; Lillis et al., 2014).

[g] *Distancing exercise* (Harris, 2009): This exercise introduces the concept of cognitive defusion. It demonstrates this concept by having the person explore what they see when their hands cover their eyes and compares this to how thoughts become "stuck" and make it hard for us to see which results in struggling to get rid of these thoughts so as to be able to function.

[h] *Ball in the pool metaphor* (adapted from Pearson et al., 2012): This metaphor parallels the effort one exerts on catching a ball in a pool to struggling with thoughts and emotions and how such struggling results in missing out in engaging with valued living activities.

[i] *Rip current metaphor* (adapted from Karekla, 2014; Kelly & Karekla, 2022): This metaphor presents how sometimes listening to what our minds or our emotions tell us (struggling), we may end up getting into more trouble (drawn in a rip current).

[j] *Tug of War with a Monster metaphor* (adapted from Pearson et al., 2012): This metaphor illustrates willingness to have thoughts and emotions and stop the struggle with them.

[k] *Mirror exercise* (adapted from Pearson et al., 2012): Mindfulness exposure to distressing thoughts about body shape and size.

[l] *Musical thoughts exercise* (Harris, 2007): Defusion from thoughts exercise, where the participant is asked to sign their thoughts to for example the music of the "happy birthday" song.

[m] *Cartoon voice exercise* (Harris, 2007): Defusion from thoughts exercise, where the participant is asked to imagine a favourite cartoon character sign the participant thoughts in the cartoons' voice.

[n] *Thought parade exercise* (adapted from Lillis et al., 2014): Cognitive defusion exercise where the individual imagines themselves looking at a big stage while large signs featuring each bothersome thought enters and exits the stage (in this case thoughts parade on a catwalk). Selena is presented to utilize these exercises to defuse from her judgmental body-shape thoughts and proceeds to carry out a photo shoot task that is of importance to her (values-based action).

[o] *Mind as a trash can metaphor* (adapted from Karekla, 2014): A self-as-context exercise that aims to develop transcendent self-awareness and assist in the recognition of the observing and thinking-self. This metaphor parallels the mind as a box or a trash can that within it one can find some useful items and some unwanted, ugly or disgusting items, yet attempts to get rid of these unwanted items leads to the addition of more "junk" in the trash-can.

[p] Questions clarifying relationship values (adapted from Ciarrochi et al., 2012): These questions were utilized in the story discussion between the avatar characters and aimed to engage the participant into exploring and clarifying their relationship-related values and then to ponder as to how they would like to act in relationships. The avatar demonstrates putting their choices in action (values-based action) and the participant is encouraged to also take similar actions.

[q] *Demons in the purse metaphor* (adapted from Lillis et al., 2014): In this metaphor worrisome and distressing thoughts are presented as demons who show up and make noise but who cannot be controlled or gotten rid of. The person is presented with a choice on how to act and the solution presented here is to place the demons in Selenas' purse and carry them with her (demonstrating willingness and acceptance of thoughts and emotions) while she engages in values-based actions (e.g., proceeding in the game).

[r] Open-ended questions (adapted from Heffner et al., 2002): These questions were used to aid in anticipating obstacles to values-based actions and future action planning.

program content and intentions of this program. Open-ended Questions (Karekla & Savvides, 2021) requested participants to provide feedback and suggestions for program future changes and improvements.

Acceptability was defined and assessed similar to other digital studies (Adery et al., 2018; Hemmings et al., 2021; Karekla & Savvides, 2021; Krentzman et al., 2015) with individual questions assessing the degree to which participants found different aspects of the program, exercises and metaphors of quality and helpful using the End-of-session and Program Satisfaction questionnaires. Additionally, acceptability was assessed by examining number of participants reporting that a particular component was most helpful vs. not helpful and the percent of active participants identifying a component as helpful. Feasibility was assessed by examining the percent of participants who reported being satisfied vs. unsatisfied by the program, whether the program duration was considered appropriate, if they would choose to participate in the program again if they needed help in the future, and if they would recommend the program to a friend who needed help with ED-related issues.

2. Results

2.1. Attrition

We defined treatment dropout as those individuals who logged in, completed pre-intervention measures and interacted with the *AcceptME* program but discontinued prematurely and did not complete the 6-sessions as envisioned by the developers. Based on this definition, 27 individuals from the 58 who enrolled in the *AcceptME* program dropped out before Session 6, for an attrition rate of 46.55%. Individuals considered to have dropped-out were however contacted via phone to explore reasons for discontinuation. A few reported facing technical difficulties (the program did not save their work so they would have to redo the session) and that discouraged continuation; or they had trouble with slow internet connection making it unfeasible to run the program from home. The majority expressed that the program would require an investment in time and they were too busy with school work or exams to be able to devote time to this program at present.

End-of-intervention data were obtained on 97% ($N = 30$; one participants' data were lost due to a technical problem) of treatment completers, and follow-up data was obtained on 81% ($N = 25$). Two participants were unable to complete assessments due to technical problems (their data could not be saved on the server and after two attempts they were not willing to answer the questions again).

Attempts were also made to contact individuals (not considered drop-outs) who did not log into the program even though they had initially agreed to participate (n = 4) to explore discontinuation reasons. All, reported that it was a matter of lack of time (due to upcoming school exams).

Screening WCS scores were compared between individuals who enrolled in the program (n = 62; M = 66.01; SD = 10.84) and those who were deemed to be at high-risk but declined participation (n = 200; M = 68.12; SD = 12.62). Univariate ANOVA showed no significant differences between the two groups ($p > .05$) on their WCS scores. A similar ANOVA was run to compare these groups on age and a significant effect was found, $F_{(4,1013)} = 13.68$, $p < .001$, $\eta^2 = 0.05$. Individuals who agreed to participate were younger (Mage = 15.17, SD = 2.15) compared to individuals at high-risk who declined participation (Mage = 16.89, SD = 2.92) and those presenting with ED symptoms and were excluded and referred for further assessment (Mage = 17.70, SD = 2.78).

2.2. Reasons for participating in AcceptME

Thirty-one participants provided information across all sessions and were included in the following analysis. The most common reason given for participating in the program was the opportunity to get expert advice ($N = 17$) followed by curiosity about the program and online help ($N = 7$), anonymity offered ($N = 6$), receiving free services ($N = 5$) without the need to go anywhere themselves ($N = 2$), and possibility of continuous support whenever needed ($N = 2$).

2.3. Participant feedback on sessions, program satisfaction, acceptability and feasibility

Table 1 summarizes session content and participant feedback on session goals and interventions. Regarding how helpful participants found each session, participants generally reported finding the sessions as quite helpful with the most helpful components being values-clarification related questions in Session 1. Mixed responses were noted for Session 2 with the exercise "listing things you have tried to make your thoughts and feeling change or go away" being endorsed as the most helpful component followed by the *chocolate cake metaphor* recognizing the inevitability of trying to control ones' thoughts and emotions, and avatar discussions demonstrating fusion with thoughts. In Session 3, most helpful components were reported to be the *Rip Current Metaphor* utilized for introducing the concept of acceptance, and the mindfulness training that followed. Most participants found the thought defusion *Musical thoughts* exercise as the most helpful in Session 4 and the discussion about relationships and values-based actions in relationships in Session 5.

The majority of participants reported being satisfied (57% Mostly Satisfied, 40% Very Satisfied). A small percentage was Mildly Dissatisfied (3%). Most participants perceived the quality of the program to be excellent to good (47% Excellent, 40% Good, 13% Fair). The majority of the participants reported that the program helped them deal more effectively with their body-related thoughts and worries (52% Helped a lot, 48% Helped a bit). About half (47%) of the participants reported that if they were to seek help again, they would return to this program and that they would recommend the program to a friend who might want to receive similar help.

The vast majority of participants reported that they learned something new from the program (92%) and that, overall, their participation was helpful (82%). All participants reported utilizing the techniques they learned, at least a little (40% A lot, 52% Somewhat and 8% A little). Forty-seven percent of participants thought that they would have been worse, 40% the same, 13% better during the past 4 months in regard to their body-related difficulties if they did not participate in the program. The aspects of the program that participants identified as most helpful were: learning how to apply acceptance techniques to manage body related thoughts (48% of participants) and identifying their values and goals (48% of participants), learning techniques to get "unstuck" from thoughts (32% of participants), realizing when they get stuck with thoughts (28% of participants), how to apply acceptance techniques to manage body related emotions (24% of participants), feeling as though they were helping the main character (16% of participants) and the mindfulness exercises (8% of participants).

When asked specifically about program duration, 45% participants reported that the duration of the program was appropriate and 29% reported it was too long. Participant critical comments for future program improvement were: *Sessions took too long to complete and preference for shorter sessions; Wish to be able to pause or stop the videos any time and be able to return to them later; and Would have liked to have additional such*

*online programs for other issues (*e.g.*, stress)*. Positive comments included: *The program was really helpful; There was nothing they did not like*; and *Really enjoyed participating.*

3. Discussion

This is the first study to apply an ACT-based selective early-intervention program for ED, delivered in a digital modality, utilizing gamification principles and a third-person perspective for intervention delivery. Overall, the program was acceptable and feasible for women and girls at-risk for developing an ED, and reportedly useful for dealing with body-related concerns. Outcomes of the trial examining the efficacy of this program further support its usefulness (author, 2022). Participants in the *AcceptME* condition were found to significantly reduce weight and shape concerns with large effect sizes and ED symptomatology, compared to the wait-list control group. Encouragingly, by the end-of-intervention the odds of falling into the at-risk category of WCS scores was 14.5 times greater for the controls compared to participants in the *AcceptME* condition. Weight and shape concern gains continued for the *AcceptME* condition at the one-month follow-up with 72% of participants scoring below the at-risk category.

The program components most commonly identified by participants as helpful were: 1) learning to apply acceptance techniques to manage body-related thoughts and 2) clarifying values (each identified by 48% of participants). Relatively fewer identified learning acceptance of body-related emotions as helpful (24%). In terms of specific interventions, the vast majority of participants identified the values interventions as helpful. The fewest participants identified the mindfulness exercise as helpful (only 8%), indicating that this might be less palatable or useful to this population or in this format, or that there was not enough emphasis on this component in the current program for it to be useful. Mindfulness may also be harder to learn in a short course and requires more time and practice for it to bear benefits. The session focused on identifying behaviors the individual engages in to avoid body-related thoughts/feelings and discovering how these behaviors are unworkable in the long run, received the lowest average rating of helpfulness (although still rated as "Somewhat" to "Very Helpful"). This suggests that this session may be targeted for improvement in a future iteration of this program.

ACT intends to help individuals choose their behaviours based on personal values. Values clarification serves multiple purposes in ACT as it increases willingness to allow difficult thoughts and feelings to occur and provides an organizational framework for behavioural changes (Wersebe et al., 2017); it is also proposed to function as a positive reinforcer for the therapeutic interventions, especially when the short-term consequences (e.g., discomfort) are unpleasant (Wilson & Murrell, 2004). That is, by engaging in values-based actions it helps individuals feel that they are doing something that matters even if it is difficult and the immediate consequence is that they may feel uncomfortable which could have served the function of a punisher for behaviour change attempts. A strong motivation is needed to relinquish emotional control strategies that provide short-term relief, even when these strategies limit behavioural repertoires (Pearson et al., 2012). In order to increase motivation for engagement and participation in the *AcceptME* program, values work began early in the intervention and continued throughout with explicit links between values and the techniques that were taught, thus providing meaning for any behavioural changes proposed. Working on values clarification from the first session gave an opportunity for the participants to imagine the life they would like to have, and how they could expand their lives to encompass much more than body-related goals (Pearson et al., 2012). This is somewhat of a departure from previous ACT manuals for dealing with eating-related difficulties (Berman et al., 2009; Heffner et al., 2002) which present values work towards the end of therapy, and may address a key deficit in this population. Further research is needed to determine whether participants' engagement is greater when values work is introduced in the initial versus later intervention sessions, and how it can be further leveraged to decrease attrition common in digitalized programs.

Other factors that played a role in engagement with the program included the opportunity to get expert advice, curiosity, and the anonymity this modality presents. As expected, participants enjoyed and found useful the gamification processes adopted in this program. Further the idea of vicarious learning from the characters within the game appeared to be effective as participants reported that they learned acceptance, defusion and valued-living skills. Vicarious learning stemming from Banduras' social cognitive theory (Bandura, 1965, 2001) is a longstanding and effective means of achieving behaviour change. It remains to be further explored however whether a first vs. third perspective viewpoint within gamification is more effective for eating related behaviour change. For instance, Rennie et al. (2016) supported that visualizing the behaviour from a third person perspective increases intention to perform that behaviour, but only if the behaviour is relatively easy to perform. A digital early-intervention program that would offer the option to choose between first- and third-person perspective for different tasks would provide further information on which viewpoint is most effective.

Participants feedback regarding drawbacks of the program included the length of the program (both the time needed to complete each session and the number of sessions), the repetition of questionnaires, and inability to pause the sessions, requiring participants to complete each session in its entirety at once. Also, due to the programs' digital requirements (high speed internet and updated browser in order to be able to "run") some technical difficulties arose, which precluded some individuals from participating. Future digital program development should address these problems. It was useful that the program could run on smart mobile phones, as some of the participants did not have access to a computer.

High attrition rates plague digital prevention and early-intervention programs for psychological health, with 1 in 4 individuals found to dropout from such programs for disordered eating (Linardon et al., 2017). Wade and Wilksch (2018) argued that low dropout rates reported in some studies are evident if only university students are included vs. higher rates if community and adolescent samples are included. Additionally, individuals with ED symptoms are particularly hard to recruit and enrol in treatment programs as the vast majority do not seek treatment for a variety of reasons, including concerns about privacy, secrecy or shame. Dropout rate was similar in this study, with overall attrition from pre to end-of-intervention being 46.55%. Most participants who dropped out did so early (immediately following Session 1). Participants reported technical problems as being major deterring factor to continuing with the program since as a result of the technical problem they would have to repeat the assessment and session again. Thus, improvements in technical aspects of the program and modifications, such as decreasing assessment time may engage participants and reduce early dropout. Shorter assessments that serve to also provide feedback to participants and may not be required for evaluation of such programs for research purposes may aid to provide clinically relevant information to participants and could act as an additional motivator for engaging with the intervention. Though not considered drop-outs, some individuals who had initially agreed to participate (n = 4) did not eventually enter the program, complete pre-intervention measures or experience any of the intervention. Additionally, a large number of individuals who met criteria declined participation before they knew what the program involved (n = 200). These individuals were not found to differ on WCS scores to those who agreed to participate, so declining participation was probably not related to severity of problems and indeed those who presented with more severe scores and ED symptomatology were referred for further assessment. Those who declined participation (and those meeting criteria for EDs and referred out) were however slightly but statistically significantly older than individuals who agreed to participate in the program. This may be an artifact of older adolescents having more time pressures with exams and being unable to participate or it may point towards early-intervention programs needing to recruit

younger adolescents who may be more likely to participate. This study did not recruit participants from a treatment-seeking sample, but rather through school and university systems. This is likely to have a lower base rate of interest and enrollment, but potentially less sample selection bias. Future modifications can provide a trailer or snapshot of the program prior to participation request, to possibly aid interest and relatability to the storyline and the characters, which was found to increase engagement and impact (Karekla et al., 2019; Yardley et al., 2016). Further, all aforementioned are important considerations for additional studies.

Limitations of this study include the broad age range which may have limited tailoring of the content and exercises for adolescents versus young adults and in turn affect acceptability of the program. Yet, the decision to include adolescents and young adults was associated with these ages presenting highest weight concerns and risk for developing EDs (Silva et al., 2017). Also, this study was designed specifically for females as most other similar studies do (Bauer et al., 2019) yet eating disorder problems occur in all genders and future studies should take this into consideration. The choice for including only females was related to males presenting somewhat differently in terms of their concerns which relate more to muscular body rather than thinness in females (see Stanford & Lemberg, 2012); and also, for convenience since a whole different story line and characters would be needed. Future programs with more available funds for digital intervention development should target young males as well. This study did not examine the effectiveness of the intervention but was mainly concerned with the acceptability and feasibility of this gamified approach to body weight and shape-related concerns among young women and girls (see XXX for the outcome study). A randomized clinical trial with longer term follow-up is necessary to examine the impact of the intervention on risk for developing eating disorders.

In conclusion, results suggest that for this group of individuals, the *AcceptME* program was acceptable and perceived as a helpful intervention to deal with body-related thoughts and worries. Feedback indicates that the delivery of digital early-intervention or risk-factor reducing programs with gamification processes is promising. Gamification processes present with many advantages that can be used in conjunction with behaviour change knowledge to produce effective digital programs. As young people use and rely more on new technologies, theory-driven game-based early-intervention programs will continue to revolutionize the field of early-intervention especially for hard-to-reach youth.

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Human rights

All procedures were in accordance with national and international ethical standards. The study was approved from the Cyprus National Bioethics Committee (ΕΕΒΚ/ΕΠ/2013/05) and the Ministry of Education.

Data availability

Data is available upon reasonable request.

Declaration of competing interest

All authors declare that they have no conflicts of interest.

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List of abbreviations

ACT	Acceptance and Commitment Therapy
ED	Eating Disorders
EDDS	Eating Disorder Diagnostic Scale
WCS	Weight Concerns Scale
PSQ	Program Satisfaction Questionnaire

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jcbs.2022.06.001.

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Program Satisfaction Questionnaire

Please help us improve our program, by responding to the following questions. Your opinion as a participant is very important to us. We are interested in your opinions whether they are positive or negative. Please choose in each question the option you feel is most appropriate.

Thank you very much in advance; we really appreciate your help.

1. How would you rate the quality of support you have received by the AcceptME program?
    1. Excellent
    2. Good
    3. Fair
    4. Poor

2. Did AcceptME give you the kind of support you wanted?
    1. No, it definitely did not
    2. No, not really
    3. Yes, to some extent
    4. Yes, it definitely did

3. If a friend was in need of similar help, would you recommend AcceptME to them?
    1. No, definitely not
    2. No, I don't think so
    3. Yes, I think so
    4. Yes, definitely

4. How satisfied are you with the amount of help you received by the AcceptME program?
    1. Very dissatisfied
    2. Indifferent or mildly dissatisfied
    3. Mostly satisfied
    4. Very satisfied

5. Has AcceptME helped you deal more effectively with your thoughts and worries in relation to your body?
    1. Yes, it helped a lot
    2. Yes, it helped a bit
    3. No, it did not help
    4. No, it seemed to make things worse

6. In an overall, general sense, how satisfied are you with program AcceptME?
    1. Very satisfied
    2. Mostly satisfied
    3. Indifferent or mildly dissatisfied
    4. Very dissatisfied

7. If you were to seek help again, would you come back to program AcceptME?
    1. No, definitely not
    2. No, I don't think so

3. Yes, I think so
4. Yes, definitely

8. What were the main reasons that you accepted to participate in AcceptME? (Multiple answers are permitted)
    1. Curiosity about a digital program
    2. Anonymity
    3. Free help, no cost
    4. Opportunity to get expert advice
    5. Ability to get help without having to travel
    6. Lack of other support options
    7. Other:

9. How much have you used/practiced the skills presented in the program?
    1. Not at all
    2. A little
    3. Somewhat
    4. A lot

10. What do you think about the frequency of episodes/sessions?
    1. Weekly is not frequent enough
    2. Weekly is appropriate
    3. Weekly is too often
    4. I would prefer the frequency to be…

11. What in particular about AcceptME helped you? (Multiple answers are permitted)
    1. Nothing
    2. I have learned a lot about applying acceptance to manage my body-related **thoughts** in my every-day life
    3. I have learned a lot about applying acceptance to manage my body-related **emotions** in my every-day life
    4. Recognizing my values and goals in life
    5. Recognizing that I get “stuck” with my thoughts
    6. Learning ways to become “unstuck” from thoughts
    7. Learning to bring my attention to the moment, to my breath-Mindfulness
    8. Feeling that I helped the main character
    9. Other:

12. How do you think you would have been during these 2 months without AcceptME
    1. Much better
    2. A bit better
    3. The same
    4. Worse
    5. Much worse

13. I have learned new things by participating in the AcceptME program:
    1. Does not apply
    2. Applies somewhat
    3. Applies mostly
    4. Totally applies

14. Was participating in the program AcceptME helpful to you?
    1. Yes, very
    2. Yes, somewhat
    3. Neither helpful nor harmful
    4. No, somewhat harmful
    5. No, very harmful

15. How do you evaluate the effort required to participate in the AcceptME program?
    1. A lot
    2. Somewhat
    3. A little
    4. Not at all

16. What do you think about the program duration?
    1. I think it is too short
    2. I think it is appropriate
    3. I think it is too long

17. Finally, we would like to ask you to provide in brief some points of criticism, both negative and positive, about AcceptME:
    1. What did you not like? What was lacking? What could be improved?

    2. What did you like? What was helpful for you?