

WELLNESS MANAGEMENT AND POSITIVE PSYCHOLOGY APP FOR  
SMARTPHONE PLATFORMS

by  
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## **Statement of Originality**

The work contained in this thesis has not been previously submitted for a degree or diploma at any other higher education institution or any other purpose. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except as specified in references, acknowledgments or in footnotes. I certify that the intellectual content of this thesis is the product of my own work and all the assistance received in preparing this thesis and sources have been acknowledged.

Evagelia Strataki

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## Abstract

This thesis describes the development of an Android application called “*BeHappier*”. The objective of the “*BeHappier*” app is to help individuals to improve their well-being and increase their life satisfaction. The “*BeHappier*” app is based on theoretical framework of Positive Psychology, a new branch in the field of Psychology.

Interventions based on Positive Psychology are methods or intentional activities (Koszycki, Raab, Aldosary, & Bradwejn, 2010) that focus on teaching people new behaviours which they will integrate into their daily lives (Michael, Fredrickson, Cohn, & Fredrickson, 2010) in order to become aware of their virtues and their strengths and to enhance positive emotions such as gratitude, savouring, kindness and hope (Manual, Children, Suldo, & Michalowski, 2007). Several recent research finding have shown that the enhancement of these emotions produce benefits beyond well-being enhancement, such as improvement of physical health (Diener & Chan, 2011), reduce subclinical symptoms of depression and the risk of clinical depression (Michael et al., 2010).

The “*BeHappier*” app consists of two (2) modes which are presented to the users as groups, which they are invited to select one of them. In the first mode of operation (Group 1), users are invited to complete a series of validated questionnaires in regular basis in order their happiness level to be measured. Additionally, they are asked to perform six (6) self-helping exercises/activities with the objective to decrease their stress and depression and increase their level of happiness and wellbeing. In the second mode of operation (Group2) users are invited to complete the same questionnaires at the same time limits as Group1, in order to estimate the baseline of their corresponding happiness level. In both modes, the application used vivid graphical representations for providing user-feedback of their level of happiness. The app also offers instructions and reminders to the users and the opportunity to share their experiences with others.

The “*Be Happier*” app is a native android application developed in the Java programming language. The app follows the principles of material design and encompasses innovative components such as scrolling tabs, navigation drawers and floating action buttons (FAB) menus, providing a simple and usable navigation. It stores its data in Firebase, hosted in the cloud, which

is a real time database, developed for high quality applications, that automatically synchronizes with every connected client, thus achieving real time application performance.

Usability and technical evaluation of the application was conducted after the completion of the development of the application. For a period of two months the app was used by smartphone users for finding bugs. New versions of the application was developed correcting all bugs identified. After this period, the evaluation of the application was conducted. Additionally, the power consumption of the application was measured for estimating the average power consumption of the application.

The usability evaluation showed that the “*BeHappier*” is simple and usable application. The screens design is clear and uncluttered, there is consistency in workflow among tasks, the documentation for the tasks completion is well-integrated and reminders are presented on time and are well informative. According to the valuation scores users not only can use the application without extra help but they feel quite confident to complete tasks without making mistakes. Finally, measurements about the app power usage shows that it has low battery consumption.

**Keywords:** Positive Psychology, Positive Psychology Interventions, Well-being, Java, Firebase.

## Περίληψη

Αυτή η διατριβή περιγράφει την ανάπτυξη Android εφαρμογής η οποία ονομάζεται “BeHappier”. Η εφαρμογή “BeHappier” βασίζεται στο θεωρητικό πλαίσιο της Θετικής Ψυχολογίας, η οποία είναι ένας νέος κλάδος της ψυχολογίας, και έχει στόχο να βοηθήσει τους χρήστες να βελτιώσουν το επίπεδο ευτυχίας/ ευημερίας τους.

Παρεμβάσεις οι οποίες βασίζονται στη Θετική Ψυχολογία είναι μέθοδοι ή σκόπιμες δραστηριότητες (Koszycski, Raab, Aldosary, & Bradwejn, 2010) οι οποίες εστιάζουν στην εκπαίδευση νέων συμπεριφορών καθώς και στην ενσωμάτωση αυτών των συμπεριφορών στην καθημερινή ζωή των ανθρώπων (Michael, Fredrickson, Cohn, & Fredrickson, 2010) προκειμένου αυτοί να συνειδητοποιήσουν τις αρετές και τις δυνάμεις τους και να ενισχύσουν θετικά συναισθήματα, όπως η ευγνωμοσύνη, η απόλαυση, η ευγένεια και η ελπίδα (Manual, Children, Suldo, & Michalowski, 2007). Πρόσφατες έρευνες έχουν δείξει ότι η ενίσχυση αυτών των συναισθημάτων εκτός του ότι βελτιώνουν ευημερία, βοηθούν στη βελτίωση της σωματικής υγείας (Diener & Chan, 2011), τη μείωση των κλινικών συμπτωμάτων της κατάθλιψης και μειώνουν τον κίνδυνο εμφάνισης κλινικής κατάθλιψης (Michael et al. , 2010).

Η εφαρμογή υποστηρίζει δύο εναλλακτικούς τρόπους χρήσης της. Κατά την είσοδο τους οι χρήστες καλούνται να επιλέξουν ένα από αυτούς ενώ δεν έχουν δικαίωμα αλλαγής ομάδας. Η ομάδα 1 καλούνται να συμπληρώνουν ερωτηματολόγια σε τακτική βάση ενώ παράλληλα εκτελούν μια σειρά από έξι (6) ασκήσεις θετικής ψυχολογία που σκοπό έχουν να μειώσουν τα επίπεδα άγχους και να αυξήσουν τα επίπεδα ευτυχίας κι ευεξίας τους. Η ομάδα 2 καλούνται να συμπληρώνουν τα ίδια ερωτηματολόγια και στα ίδια χρονικά διαστήματα με τους χρήστες της ομάδας 1, με στόχο απλά να καταγραφεί το επίπεδο βάσης (baseline) της ευτυχίας κι ευεξίας τους. Η εφαρμογή παρέχει στους χρήστες και των δύο ομάδων πληροφορίες για το επίπεδο ευτυχίας τους, μέσω εύχρηστων γραφικών εργαλείων. Παρέχει επίσης οδηγίες και ειδοποιήσεις στους χρήστες ενημερώνοντας τους για τις επικείμενες δραστηριότητες τις οποίες θα πρέπει να εκτελέσουν καθώς και τη δυνατότητα να μοιραστούν τις εμπειρίες τους με άλλους χρήστες της εφαρμογής.

Η “Be Happier” είναι μια γνήσια (native) android εφαρμογή η οποία αναπτύχθηκε σε γλώσσα προγραμματισμού Java. Ο σχεδιασμός και η ανάπτυξής της έγινε σύμφωνα με τους κανόνες του material design συμπεριλαμβάνοντας καινοτόμα σχεδιαστικά εργαλεία όπως

scrolling tabs, navigation drawers και floating action buttons (FAB) menus, παρέχοντας στο χρήστη εύκολη, γρήγορη κι ευχάριστη περιήγηση. Η εφαρμογή αποθηκεύει τα δεδομένα της σε μια βάση (Firebase) που φιλοξενείται στο cloud. Η Firebase είναι μια βάση δεδομένων πραγματικού χρόνου (real time database), σχεδιασμένη για την εξυπηρέτηση υψηλής ποιότητας εφαρμογών, παρέχοντας στους χρήστες ενημερώσεις για τις αλλαγές στη βάση μέσα σε χιλιοστά του δευτερόλεπτου.

Μετά την ολοκλήρωση της ανάπτυξης, έχει διεξαχθεί τεχνικός έλεγχος καθώς επίσης και έλεγχος ευχρηστίας της εφαρμογής. Για διάστημα δύο μηνών η εφαρμογή χρησιμοποιήθηκε από χρήστες για εντοπισμό πιθανών σφαλμάτων. Νέες εκδόσεις της εφαρμογής εκδόθηκαν οι οποίες διόρθωναν όλα τα λάθη που εντοπίστηκαν και αναφέρθηκαν. Μετά το πέρας αυτού του διαστήματος διεξήχθη έλεγχος ευχρηστίας. Επιπροσθέτως, έχουν γίνει μετρήσεις για τον υπολογισμό της μέσης κατανάλωσης ενέργειας της εφαρμογής.

Τα αποτελέσματα του ελέγχου ευχρηστίας (usability evaluation) έδειξαν ότι η εφαρμογή είναι αρκετά απλή κι εύχρηστη. Ο σχεδιασμός των οθονών είναι λιτός, υπάρχει συνέπεια στην ροή εκτέλεσης των διεργασιών, οι οδηγίες για την ολοκλήρωση των διεργασιών είναι σαφής και ολοκληρωμένες και τα μηνύματα υπενθύμισης εμφανίζονται εγκαίρως και είναι απλά και κατανοητά. Σύμφωνα με τα με τα αποτελέσματα της αξιολόγησης οι χρήστες θεωρούν ότι μπορούν να χειριστούν την εφαρμογή χωρίς τη βοήθεια ειδικού και να εκτελέσουν διεργασίες χωρίς να κάνουν λάθη. Τέλος οι μετρήσεις κατανάλωσης ενέργειας έδειξαν ότι η ποσότητα ενέργειας που καταναλώνει η εφαρμογή είναι χαμηλή.

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## List of Acronyms

ACT	Acceptance and Commitment Therapy
BA	Behavioural Activation
BSI – 18	Brief Symptom Inventory -18
CAS	Cognitive Attentional Syndrome
CBASP	Cognitive Behavioural Analysis System of Psychotherapy
CBT	Cognitive Behavioural Therapy
DBT	Dialectical Behavioural Therapy
FAB	Floating Action Button
FS	Flourishing Scale
GQ	Gratitude Questionnaire
ICTs	Information and Communication Technologies
IHCA	Interactive Health Communication Applications
ISO	International Standards Organization
LOT-R	Revised Life Orientation Test
MAAS	Mindful Attention Awareness Scale
MBCT	Mindfulness Based Cognitive Theory
MCT	Metacognitive Theory
PPI	Positive Psychology Interventions
PT	Positive Technology
QoE	Quality of Experience
SG	Serious Games
SHS	Subjective Happiness Scale
SPANE	Scale of Positive and Negative Experience
ST	Schema Therapy
SUS	System Usability Scale
SWB	Subjective Well Being
WB	Well Being

# 1 Introduction

Nowadays a new branch of psychology, called Positive Psychology, studies human's abilities, virtues, and talents. The main aim of Positive Psychology is to motivate individuals and communities to thrive and flourish (Munson, Lauterbach, Newman, & Resnick, 2010) and not merely to treat mental disorders (Stalikas, 2011). In detail, it analyses happy humans' attributes and abilities and the way these attributes can be cultivated to less happy people in order to make them happier. Positive Psychology claims that all people can be happier, even the happy ones. This can be done by enhancing positive feeling, behaviours and cognitions (Koszycki et al., 2010).

Positive Psychology Interventions are methods or intentional activities (Koszycki et al., 2010) that focus on teaching people skills in order to generate positive emotions to themselves (Michael et al., 2010). The main aim of Positive Psychology Interventions, as a result, is to teach people new behaviours, which they will integrate into their daily lives (Michael et al., 2010) in order to become aware of their virtues and their strengths and to enhance positive emotions such as gratitude, savouring, kindness and hope (Manual et al., 2007). Surveys have shown that the enhancement of these emotions produce benefits beyond well-being enhancement, such as improvement of physical health (Diener & Chan, 2011), reduce subclinical symptoms of depression and the risk of clinical depression (Michael et al., 2010).

Based on this theory an Android application was developed named "*BeHappier*". The aim of the "*BeHappier*" app is twofold: to teach the users new behaviors in order to improve their well-being, increase their life satisfaction and give them track of their happiness level. For the first purpose the application features the following six (6) Positive Psychology exercises/activities: a) the "*Three Good Things*" aims to teach users to think and focus on positive experiences, b) the "*Savoring*" exercise helps users to acquire savoring skills, c) the "*Hope*" exercise teaches users to think positive and practice hopeful thinking, d) The "*Optimistic Thinking*" teaches users to develop optimistic thinking, e) The "*Acts of Kindness*" activates people to do acts of kindness, and f) the "*Gratitude Visit*" helps people to express gratitude towards other people and experience the feeling of gratitude. For estimating user's level of happiness, the application encompasses of series of validated questionnaires, which are the following: a) Psychological Well-Being, b) Life Satisfaction Scale, c) Brief Symptom Inventory

-18, d) Flourishing Scale (FS), e) Scale of Positive and Negative Experience (SPANE), f) Mindful Attention Awareness Scale, g) Hope Scale, h) Revised Life Orientation Test i) Subjective Happiness Scale, and j) Gratitude Questionnaire. Finally the application offers to the users the opportunity either to practise exercises and to complete questionnaire or to complete questionnaire only for estimating the level of their well-being.

## **1.1 Scope and Objective**

The present thesis aims to present the process of development and the evaluation of the Android application called “BeHappier”, which is based on Positive Psychology. More specifically, the application, the theoretical background in which the application is based on, the usability and technical evaluation of the application are presented. The scope of this thesis is the development of the application “BeHappier” which is a smartphone application based on Positive Psychology. The app consists of two (2) modes which are presented to the users as groups (Group 1 and Group 2) and they are invited to select one of them.

In the first mode (Group 1) the users are invited to perform six (6) self-helped exercises/activities along a 6-week period, aiming both at decreasing their stress and depression and increasing their level of happiness and wellbeing. This is an innovative program of exercises which aims to develop positive feelings about the past (e.g. gratitude visit), the present (e.g. acts of kindness) and the future (e.g. exercise in hope), with the ultimate scope to increase users’ happiness and reduce stress, anxiety and depression. It also offers to the users the opportunity to share their activities and see other users’ posts (or what other users have posted). After being acquainted with the exercises, the users can continue to perform the exercises they prefer. Additionally, the users are invited to complete a series of validated questionnaires to assess their level of happiness and well-being before and after the completion of each exercise/activity and also before and after the completion of the whole program of exercises/activities. Charts keep track of their happiness level and provide feedback to the users about any possible changes in their level of happiness and wellbeing or about symptoms of anxiety and depression. In the second mode (Group 2) the users are invited to complete the same questionnaires at the same time limits as the users in the first mode. Again, their level of happiness is measured and charts present graphical illustrations to them. Both modes, offer to the users instructions and notifications to guide them about the tasks they have to perform.

## **1.2 Thesis Overview**

The organization of this thesis is the following:

Chapter 1 includes an introduction to the topic of the thesis, highlighting its scope and objectives.

Chapter 2 presents the theoretical foundations of the project, elaborating on the Positive Psychology methodology, on the concept of Well-being and Well-being enhancement methods.

Chapter 3 presents an elaborate review of recent research efforts on Positive Psychology, referred to as the Third Wave Cognitive Behavioural Therapy and an analysis of Positive Psychology Interventions, as well as the technology used for well-being enhancement, called Positive Psychology technology.

Chapter 4 presents the technical implementation of the project. In detail, it presents the theoretical background of the Positive Psychology exercises/activities included in the application, the application's flowchart, the technologies and tools used for the development of the application and detailed description of the exercises/activities and questionnaires are included in the application.

Chapter 5 presents the technical and usability evaluation of the app, describing the methods used and the data analysis performed. Finally, Chapter 6 includes a discussion over the evaluation of the application, and Chapter 6 concludes with recommendations for potential future work and extensions.

## **2 Background**

Traditionally psychology has been focused mainly in diagnosis and treatment of psychological disorders, like depression and anxiety. However, the last decades it was acknowledged that although many people were free of mental disorders, they were not happy, but they exhibited instead high levels of dissatisfaction in their everyday life (Bolier et al., 2013). Late in the last century, Seligman, Csikszentmihalyi, Lyubomirsky, Fredrickson, & Folkman, as referred by (Stalikas, 2011), raised the question of whether the lack of mental illness is mental health. Therefore, a new branch in Psychology, known as Positive Psychology, emerged in 1998 by Seligman (Stalikas, 2011).

Nowadays psychology is studying issues related to human development such as the meaning of life, human growing capabilities and the psychological wellbeing. Research has shown that positive variables such as hope, optimism, faith, psychological resilience, wisdom, joy, love and happiness have beneficial effects on the strengthening of psychology. Likewise, very important is the enhancement of the positive characteristics of human personality as the ability to love, to offer, to forgive, perseverance, courage wisdom etc. (Stalikas, 2011). Positive psychology focuses on the psychological well-being and life satisfaction (past), interest and happiness (present) and the optimism and hope (future)(Stalikas, 2011).

### **2.1 Positive Psychology**

Positive psychology is a branch of psychology which studies human's abilities, virtues, and talents. It studies the factors which motivate individuals and communities to thrive and flourish (Munson et al., 2010). In other words, it studies the optimal functioning in the sense of leading a pleasant, successful, social, meaningful life (Flöttmann, 2016). It mainly aims to the attainment of life satisfaction than the treatment of mental disorders (Stalikas, 2011). It analyses attributes of the human being such as abilities, the meaning of life, quality of life, psychological resilience, prosperity, optimism, positive emotions, talent and personal work – life balance. It points out that positive emotions and positive dimensions of human existence are structural components of happiness and psychological health. Surveys have shown that joy, interest, pleasure, finding the meaning of life, the expression of positive emotions and optimism are important for satisfaction and structuring substantive and interpersonal bonds (Stalikas, 2011).

All these contribute to increased productivity, greater personal and professional satisfaction, helping others, and improve the achievement of individual goals. People who experience the above seem to be healthier, fitter and with longer life expectancy (Diener & Chan, 2011).

One of the basic concepts of positive psychology is "life with purpose and meaning" that represents an ideal situation. Seligman in 2002 as referred by (Stalikas, 2011) suggested that in order a person to experience "life with purpose and meaning" the following criteria should be fulfilled a) positive and meaningful relationships with others, b) the positive personality traits and positive emotions and c) avoiding extravagance.

Basic assumptions of positive psychology are the following (Stalikas, 2011):

- People are social and adaptable being.
- The human qualities can evolve and create a sense of flourish and prosperity.
- A person's skills and qualities play a key role in the sense of well-being and happiness.
- Happiness is a social good.
- Reasons that cause positive emotions are different from those that cause negative ones.
- Eliminating negative emotions does not necessarily mean experiencing positive ones.
- Different causes result in different positive emotions that have different effects.
- Negative feelings are as important as positive ones.

Positive psychology studies the enhancement of human's character through Positive Psychology Interventions (PPI). Seligman, Steen, Park and Peterson claim that these are viable methods for building happiness with long-lasting effect (Manual et al., 2007). These methods are used from clinicians particularly for treating clients who are depressed or for whom are highly motivated to improve their level of happiness (Koszycki et al., 2010). Additionally, a recent theory by Seligman (2011), as referred by (Schueller & Parks, 2012), recommends five pathways for wellbeing enhancement: positive emotions, meaning, engagement, achievements and relationships.

A key concept of positive psychology is to encourage human to adopt positive attitude and to propose ways of achieving prosperity and happiness. It introduces the concept of "positivity". Ferdrickson & Losada (2005), as referred by (Stalikas, 2011), described the "positivity" as the situation experienced in physical, cognitive and emotional level when a person experiences positive emotions and not just pleasure. Positivity is changing the way a person perceives and understands the environment that he/she lives, and enhances his /her physical,

cognitive and psychological health. It helps people develop healthy and meaningful social relationships, reduce negativity and improve the quality of their life. The opposite of positivity is negativity, which is the negative mood that people feel when they have negative thoughts or feel negative emotions like hatred, jealousy, insecurity, resentment. Negativity is usually accompanied by blood pressure, stiff muscles, stomach pain etc.

## **2.2 Happiness**

Happiness is a positive feeling. It is the long-term and overall sense of psychological well-being in combination with life satisfaction. Many interpretations have been given to happiness. Some researchers have defined happiness as the overall estimation of a person's life while others have defined it as a subjective and long-term assessment of the balance between the positive and negative emotional experience.

It could be said that the definition of happiness are grouped into three basic theoretical categories (Stalikas, 2011): a) Hedonism, which suggests that happy people are those who experience several moments of pleasure and a few moments of pain and sadness. b) The theory of desire, which suggests that happy people are those who have their desires met. c) The theory of objective list, which links happiness with a number of important achievements such as the successful career, friendship, health, material goods, beauty, education, knowledge and the conscience. Seligman (2002) proposed the term authentic happiness to include the three above theories.

Studies on happy people have shown that they have good social relationships and pleasant everyday lives. Diener and Seligman (2002), as referred by (Otake, Shimai, Tanaka-Matsumi, Otsui, & Fredrickson, 2006), pointed out that happy people have highly satisfying relationships with family members, friends and partners and they report more positive events in their everyday lives than negative ones. Furthermore, happy people are highly motivated to perform, they exhibit courteous behavior and they have a large amount of pleasant memories in quantity and quality.

Research conducted by scientists in psychology has shown, that the personality traits of happy people are (Stalikas, 2011): they are active, social, extroverted, original, productive, organized, they have intimate relationships, low levels of anxiety and other negative emotions, reduced expectations, positive thinking, they are oriented in the present, focused on healthy

personality, and of course, their priority is the achievement of happiness (Weytens, Luminet, Verhofstadt, & Mikolajczak, 2014).

Likewise, psychological factors that seem to be associated with happiness are (Stalikas, 2011): a) The positive personality traits such as optimism, self-esteem, and the sense that the person controls his/her life. b) Flow, which is when someone is absorbed by an activity in such a way that loses the feeling of consciousness of his/herself. c) Close and supportive relationship, which is the people around the person with whom he/she can share the sadness or joy. d) The religious communities which operate as places to communicate and react with other people and strengthen hope.

Happiness is the aim of human life, not only because it is something pleasant but because it brings a number of positive effects in one's life. People with high levels of happiness are more likely to graduate from the university, be engaged in a work, keep their job, take promotion at work, have good relations with their colleagues, develop healthy social relationships and have good family relationships, whereas it is less likely to develop delinquent behaviour or make substance abuse. Finally, they have better physical and mental health.

Seligman (2002), as referred by (Manual et al., 2007), claimed that people are capable to improve their happiness level by doing intentional activities. He suggested that people should pay attention to emotional aspects of their life as far as their past, present and future is concerned. To increase the feeling of satisfaction with the past they can express their gratitude for positive events. In terms of the present, they should increase the levels of pleasures and gratifications through identifying their personal strengths and virtues. Lastly, in terms of the future, he suggested that people should learn to be more optimistic.

### **2.3 Well Being**

As mentioned above, the science of Psychology studies happiness, its impact and results on human psychology. Over the years, it became clear that how people experience happiness is very important. It is also important to be acknowledged how people themselves experience the positives and negatives events in their everyday life. Many terms have been used, such as Wellness, Well Being (WB) and Subjective Well Being (SWB), Which although they are often been confused with the term happiness, they are different. The term happiness is defined by a clear theoretical framework, which has already be defined in the above section (section 2.2.

Happiness) (Barbut, 2009). On the other hand, subjective well-being is defined in terms of how people experience the quality of their lives subjectively and not how psychology defines it. SWB encompasses people's emotional reactions and cognitive judgments. Positive psychology systematically studies SWB, its importance on human's psychology, the way that SWB empower happiness levels and ways to enhance psychological well-being.

In the past, many philosophers and social scientists have tried to define the term well-being or subjective well-being. Definitions can be grouped into three categories (Barbut, 2009). First, well-being has been defined indirectly by external criteria as humans make judgments for themselves influenced by social and cultural criteria and by the era they live. Aristotle said that "eudemonia is gained by leading a virtuous life" (Barbut, 2009). He rather talked about the normative standard of the era which a man lives. Second, scientists studied what makes people happy. Well-being has been linked with life satisfaction. It is important to be said that each person has his/her own standard to determine what good life is. Shin and Johnson (1978), as referred by (Barbut, 2009), defined WB as the overall and subjective estimation of one's quality of life. Checota (1975), as referred by (Barbut, 2009), defined WB as the overall satisfaction derived from the accomplishment of one's desires and goals. Thirdly, scientists have also focused on the fact that happy people feel more pleasant feelings than unpleasant during a long period of time, either because they actually experience more pleasant events than unpleasant or because they have learned to focus mostly on positive events.

Likewise, well-being is characterised by three features (Barbut, 2009). First, it is the experience of the individual and thus it is subjective. Second, the absence of negative events is not enough for one experiencing well-being and moreover, positive events should outweigh the negative ones. Third, well-being is defined subjectively by the overall assessment of a person's life.

In the same way, psychological well-being was determined by Diener (1984), as referred by (Koszycki et al., 2010), as a state characterized not only by the absence of psychological disorders but in parallel to this by the existence of positive affect, life satisfaction and happiness. In short, WB is a cognitive state which consists of good feelings and positive thinking of life.

Psychology scientists claim that the following three factors play a key role for WB: genetics, circumstances and intentional activities (Ouweneel, Le Blanc, & Schaufeli, 2014; Lyubomirsky & Layous, 2013; Flöttmann, 2016). It is true that some people focus mainly to

positive events, directed by genetic influences. Nevertheless, genetic factors do not determine whether one feels happy or not. Living conditions and life circumstances play important role. Additionally, intentional activities seem to play significant role in people's WB. People can do things purposely in order to feel well.

Surveys have shown that subjective happiness does not depend on the age or gender. Furthermore, they have shown that subjective happiness seems to be independent from economic prosperity. People who live in medium income countries seem to be happier than those who live in countries with a low standard of living and those who live in countries with high per capita income. Additionally, people familiarise themselves with the positive events, so that they do not have any long-term effect on their level of happiness.

In conclusion, WB makes people realize their own abilities, cope with stress and life's difficulties and also act productively and contribute to their communities. The benefits of well-being include productivity to work, more meaningful relationships, better physical health and healthy lifestyle (Bolier et al., 2013).

## **2.4 Well Being Enhancement**

Besides what it has already been mentioned happiness depends on genetics or biological markers, life circumstances and purposeful activities. So, some people experienced higher levels of happiness because of their genes. Circumstances are facts of our lives that we cannot change easily, such as where we stay, how old we are, how much money we have, how educated we are and so on. Hopefully, we can enhance our well-being with purposeful activities. Thus, we can change the way we think, we act, interact with others, and also our attitudes and goals in order to increase our level of happiness. Everyone has the opportunity to be happier. For this purpose we can recruit concepts, aspects, thoughts, feelings and activities from our past, present and futures. What we have to do is to learn how to be more optimistic with which we will have more desirable academic, business, social and health outcomes (Manual et al., 2007).

Psychologists suggest Positive Psychology Interventions (PPI) strategies for well-being enhancement. PPIs encompass methods and intentional activities to cultivate positive feelings, behaviours and attitudes (Koszycki et al., 2010). PPIs prompt people to engage into positive intentional activities such as gratitude visits, replay positive experiences, practice optimistic thinking, grateful, optimistic and mindful thinking (Lyubomirsky & Layous, 2013). Seligman,

as referred by (Weytens et al., 2014), introduces exercises in order people use their strengths, perform good things, recall their past, express their gratitude, act and respond positively, and savour life.

Studies have shown that PPIs can be beneficial to those who suffer from depression, as they can increase positive emotions and prevent relapses (Koszycki et al., 2010). It has been found that practicing intentional activities can ameliorate depression and improve WB (Koszycki et al., 2010; Lyubomirsky & Layous, 2013). Besides, studies have shown that PPIs have great effect in boosting positive feelings, in engagement and in life meaning. It has been found that better outcomes have those who practice multiple intentional activities compared to those who practice only one. Besides, these activities have a greater impact if practiced for a long period of time (i.e. become habits). Clinicians apply PPIs in group therapy or in individual therapy. Furthermore, intentional activities can be practiced from everyone who, despite not suffering from any psychological disorders, don't feel happy and want to increase his/her level of happiness.

Intentional activities can be practiced into three levels: past, present and future. The purpose of intentional activities is to boost positive thoughts, feelings, activities and attitudes as far as concern the above periods.

Positive feelings related to the past are pride, serenity, fulfilment, satisfaction, gratitude and contentment (Bognar, 2004). Positive and negative feelings arise from events, actions, and relationships in the past. If someone dwells in the negative events, negative feelings persevere. Intentional activities like gratitude visit make people focus on positive thoughts in the past and bring good memories into the surface. Seligman suggested that the positive feelings related to the past are pride, serenity, fulfilment, satisfaction, gratitude and contentment (Manual et al., 2007).

Positive feelings related to the present include joy, calm, pleasure, joy, zest, ecstasy, ebullience and flow (Manual et al., 2007). Positive feelings can be divided into two types: those that make us feel pleasure (which is momentary and has short duration) and those that make us feel gratification. Intentional activities aim at gratification incensement and target on strengthen one's character. Character strengths are moral virtues such as integrity, courage, fortitude, honesty, originality and loyalty. Those virtues are built-up and use by choice.

Positive feelings related to the future are faith, hope, trust, confidence and optimism. Intentional activities aim at cultivating and strengthening optimism and hope because these

feelings buffer against stressful life events. These activities teach people to think positive events as permanent and negative life events as temporary and specific. In this way people engage in a more positive lifestyle.

In the following sections, the intentional activities that need to be practised to enhance these feelings will be presented.

### ***2.4.1 Gratitude***

Gratitude has many benefits in well-being and consequently in happiness. For this, it is important people practise behaviours which lead to gratitude and the most important is to turn these actions into habits. Furthermore, gratitude may lead to other positive feelings such as savouring, enthusiasm, inspiration, joy, love, kindness and may turn our thinking into positive which blocks negative thoughts that our brain has the tendency to focus on.

Gratitude can be directed towards life experiences and people. Researchers have shown that people who experience a gratitude visit (i.e., a visit aimed at expressing gratitude), has positive effects (Parks & Seligman, 2007; Weytens et al., 2014; Manual et al., 2007). A gratitude visit is described as an intentional activity in which people think of persons who have helped them in some way or who have been especially kind to them and they would like to express gratitude (Parks & Seligman, 2007.; Manual et al., 2007; Ouweneel et al., 2014; Weytens et al., 2014). They are guided to write a letter to express their gratitude analysing what this person has done for them and how they felt. Then, they are instructed to handle the letter and read it to the receiver. After the gratitude visit, people have to write how they felt while they were writing the letter, how they felt when they gave the letter to the receiver, what was the reaction of the receiver, and how were they affected from receiver's reaction. Studies on gratitude visits have found that participants felt positive feelings, such as kindness, pride, love, enthusiasm, and gratitude. Besides, receiving kindness by the other person strengthened even more their positive feelings.

### ***2.4.2 Gratification***

As mentioned earlier, gratification is often confused with pleasure. People usually feel pleasure doing activities like having a good meal, smelling a flower, going to a nice place etc. These feelings are momentary and nor long-lasting. On the other hand, behaviours like helping others, achieving a goal or doing something good offer gratification. Gratification is a deeper and

more substantive feeling, as it includes fulfilment, self-confidence, self-assurance, pride, aplomb and other good features.

According to psychology experts, it is vital people to engage in activities that even when they have finished they yield positive emotions. They suggest purposeful activities that cultivate practitioners' virtues and talents. (Manual et al., 2007; Ouweneel et al., 2014; Otake et al., 2006) referrer that, Seligman, Lyubomirsky, and other experts claim that acts of kindness have great impact in one's happiness level. When people express kindness to others or perform actions of kindness the other people express their gratitude to them. In this way, kindness generates gratitude and gratitude generates kindness. People feel good about themselves when they perform acts of kindness like helping others. Therefore, psychologists suggest weekly programs in which participants record their acts of kindness daily (Parks & Seligman, 2007; Ouweneel et al., 2014; Manual et al., 2007; Otake et al., 2006). The main purpose of these programs is to educate participants to engage in acts of kindness in their everyday life.

Other programs designed in a weekly base aimed at making participants feel gratification are the following:

- Register three good things that happened during the day and think why these good things happened(Parks & Seligman, 2007; Munson et al., 2010).
- Review the daily routing and consider how much time you spend noticing and savouring the pleasures of the day (Parks & Seligman, 2007).
- Identify virtues or strengths of your character and use one of them every day in a way that have not before used (Parks & Seligman, 2007; Manual et al., 2007).
- Write an essay with your life summary and write what you would like to remember the most, your achievements and traits.

Research has shown that such programs have a positive impact on human psychology, such as people become happier through kindness intervention (Koszycki et al., 2010; Otake et al., 2006; Ouweneel et al., 2014), gratefulness interventions (Ouweneel et al., 2014; Weytens et al., 2014; Parks & Seligman, 2007), and savouring interventions (Weytens et al., 2014; Parks & Seligman, 2007).

### ***2.4.3 Hope***

Psychology experts define hope as a cognitive process which consists of two basic components, which compliments one another: the ability a person has to envision methods for achieving his/her goals and the way that utilizes these methods to achieve his/her goals (Stalikas, 2011; Manual et al., 2007). Having hope means that a person believes that he/she can find ways to achieve his/her goals; having achieved his/her goals, the person feels confident to achieve further goals. On the other hand, if a person uses certain methods but fails to achieve his/her goals, he/she becomes motivated to modify these methods in order to achieve his/her goals. As we can see, both of them complete and enhance each other.

An intentional activity that can enhance the feeling of hope is inviting participants in a weekly basis to think activities (i.e., “I would like to find new friends”, “I would like to play basketball but there is no basketball team in my school”) that are important to them and think about strategies to accomplish these activities. They are then invited to write their ideas of how to reach their goals. Finally, they have to discuss their ideas and the difficulties they thought that they would probably encounter (Manual et al., 2007).

### ***2.4.4 Optimism***

According to Sheier and Carver, as referred by (Stalikas, 2011), optimism is a person’s belief that good things rather than bad things are more possible to happen to him/her. Researchers have shown that optimistic people have the faith that at the end something good will happen and increased capabilities to solve problems. Optimistic people feel less loneliness, experience more life satisfaction, have less stress and increased well-being. If something bad happens to pessimists they tend to think that they have done something bad they blame their selves. On the other hand if something good happen to them, they think that this happened by chance.

The question is “can people learn to think more optimistic?” psychologists say yes. The key point is to make them think of good things as permanent and that they have happened thanks to them and bad things as temporary, and that they have happened because of other causes. An intentional weekly-based activity in groups that focuses on making participants to think optimistically asks them to think and write events that have happened to them. For positive events participants should write optimistic thoughts and why they have happened, while for

negative events they should think of them as specific and blame other sources. Then another member of the group would add optimistic thoughts about these events. Thus they show to the participants that optimistic thinking has the snowball effect (Manual et al., 2007).

### 3 Literature Review

Mental health disorders and depression more specific harms people and causes several problems in their everyday life (Fleming et al., 2014). Although, many treatments options are available, mental health disorders remain a global public health problem (Depressive & Lyubomirsky, 2011). Unfortunately, many people around the world suffering from mental health disorders do not receive the recommended level of treatment. It has been reported that in affluent nations only 70% of cases either don't receive the proper level of treatment or they do not get treated at all. While, in developing countries only the 10% of cases which need treatment get the recommended level of treatment (Depressive & Lyubomirsky, 2011). These disorders lead to several problems such as social, occupational, economic and increase mortality and suicides (Watkins et al., 2012). Our society has negative stereotypes about people suffering from mental disorders (Moses, 2010). Additionally, traditional treatments are costly or not appealing to some people. Hence, stigmatization and cost of treatment are the main reasons that people not get proper treatment while the problem is bigger for people with low and middle incomes (Lund et al., 2011).

Although many people don't suffer from mental illness they still feel unhappy. Hence, the absence of mental illness does not necessarily equal to mental health. The treatment and prevention of mental illness is important but the most important of all is to make people flourish. Huppert (2009), Keyes (2002), Ryff and Singer (1998), as referred by (Huppert & So, 2013), characterized flourishing as a desirable condition with high well-being and positive mental health. Flourishing encompasses feelings and functioning and it is equal to hedonic and eudemonic aspects of well-being such as positive emotions, good relationships, emotional stability, engagement, self-esteem, resilience, competence, meaning, optimism, and vitality (Huppert & So, 2013). Seligman (2002), as referred by (Huppert & So, 2013), suggested that "authentic happiness" has the following three elements: pleasure, engagement and meaning.

Taking into consideration the above, it is important for people to cultivate positive feeling and engage in such a lifestyle that makes them happy. In other words people should adopt behaviours and cultivate skills like the following (Yarosh & Schueller, 2017):

- Intrapersonal: The ability to deeply understand ourselves (self-knowledge).
- Interpersonal: The ability to interact and communicate with other people.

- Change and uncertainty: Understanding that changes and uncertainty are part of our life, or that things change over the time (impermanence).
- Balance: The ability to maintain balance among aspects of our life such as interpersonal, intrapersonal, interests and perspectives. To respect and share the environment we live. To experience emotions like equilibrium, moderation and regulation.
- Relativism: To have dialectical thinking, or to have the ability to understand multiple perspectives of all things, to be open-minded.
- Mindfulness: To understand whatever happens to us and pay attention to the present moment. To learn how to be silent and spend time to deeply understand and feel whatever happens around us.
- Reflected insight: To be willing to learn more about our self. To get deeper insight into our self.
- Social consciousness: To be aware of things happening around us and important social issues. To be willing to help others and take actions in order to improve the conditions humans live and our society in general.

Adopting and cultivating some of the aforementioned skills can potentially increase people's happiness and wisdom.

### **3.1 The Third Wave Cognitive Behavioural Therapies**

The Third Wave of Cognitive Behavioural Therapies are methods of psychotherapy that are used for the treatment of psychological disorders. Behavioural therapy focuses on behaviours along with thoughts and feelings and it has its roots in the 1950 (Kahl, Winter, & Schweiger, 2012). The first wave of psychotherapy was unstructured and focused on classical conditional (Hayes, 2004). The therapist had a passive role. The second wave of Cognitive Behavioural Therapy was more contemporary and focused on information processing. The third wave focuses on new aspects of psychotherapy and combines emotions, cognitive fusion, dialectics, acceptance, spirituality, mindfulness and therapeutic relationships (Kahl et al., 2012). It has proven to be effective especially for those patients who had difficulties to be treated with traditional models. The Third Wave of Cognitive Behavioural Therapy approaches are divided into seven main categories of treatment according to the treatment method, the theoretical

principles and the target group of disorders (Kahl et al., 2012; Hayes, 2004; Churchill et al., 2013). These will be briefly presented in the following sections.

### ***3.1.1 Acceptance and Commitment Therapy***

Acceptance and Commitment Therapy (ACT) is a method that studies the relationship between the experience of symptoms and bad thoughts and feelings (Churchill et al., 2013). According to ACT, it is important for people to acquire skills resulting from the following six principles (Hayes, 2004; Kahl et al., 2012):

- *Cognition*: To have the ability to perceive thoughts, feelings, emotions, memories as they really are and not as they appeared to be.
- *Acceptance*: Accept feelings and thoughts without avoiding or fighting (?) them.
- *Be in the present*: To understand what happens in the present time. To be aware of here and now.
- *Observing*: To observe yourself and have the sense of yourself.
- *Personal values*: To find out what is the most important to you.
- *Commit*: Set goals and try to achieve them responsibly.

Surveys have shown that ACT is effective in heterogeneous clinical conditions (Kahl et al., 2012). It uses relaxation training in reducing symptoms of obsessive compulsive disorders and of smoking cessation. Additionally, ACT can be used to reduce shame in people with substance use disorders. Also, it is useful in pain, eating disorders, drug dependence, anxiety disorders and psychotic disorders. Finally, ACT helps people to change their lifestyle and adopt a healthier life style by engaging in physical activity.

### ***3.1.2 Behavioral Activation***

In 1996 Jacobson manualized the Behavioral Activation (BA) therapy (Churchill et al., 2013). This model educates people to relax and encompass skills such as increasing pleasant events, problem solving skills and socialization skills. In 2001 Martell extended BA by encompassing methods focusing on the treatment of depression and mental disorders (Kahl et al., 2012; Churchill et al., 2013). The main changes were a shifting from pleasant activates to more value driven activates and the adoption of concepts influenced by ACT. The goal of BA is to encourage patients to adopt antidepressant activities, to troubleshoot and to reinforce them into positive attitude. Cognitive Behavioral Analysis System of Psychotherapy

The Cognitive Behavioural Analysis System of Psychotherapy (CBASP) is the only therapy specifically designed for the treatment of chronic depressive patients (Kahl et al., 2012; Swan & Hull, 2007). The goal of CBASP is to teach patients to have operational thinking and cultivate interpersonal behaviours driven by empathy and personal values. It applies three therapeutic techniques, namely a) situational analysis, b) interpersonal discrimination, and c) consequating strategies.

CBASP's emphasis is on encouraging patients to interact with their environment while teaching them how to interact with others taking into consideration that patients suffering from chronic depression are trapped in repetitive behavioural patterns (Swan & Hull, 2007). It applies an algorithm using cognitive behavioural and interpersonal techniques and is effective for treating patients' social-problem solving (Kahl et al., 2012; Swan & Hull, 2007).

### ***3.1.3 Dialectical Behavioural Therapy***

The Dialectical Behavioural Therapy (DBT) was mainly developed for parasuicidal patients with personality disorders (Kahl et al., 2012; Salmon, Sephton, & Dreeben, 2011). Modifications of DBT were developed for substance abuse and eating disorders (Kahl et al., 2012). DBT cultivates a broad range of skills such as distress tolerance, emotion regulation, interpersonal skills and mindfulness in order to control anger and decrease suicidal behaviours. Taking into consideration that people who have suicide behaviours believe that they are not worth living. So it is important not only to teach them to cope with distress but also to make them believe that it is worth living (Salmon et al., 2011).

DBT encloses elements of many other areas of psychology like biosocial theory of psychopathology, learning theory, dialectical philosophy, social psychology, acceptance strategies, change strategies, and dialectical treatment strategies (Salmon et al., 2011). DBT has been shown that not only reduce symptoms but has great impact inpatients' personality (Kahl et al., 2012).

### ***3.1.4 Metacognitive Therapy***

Metacognitive Theory (MCT) comes from the evolution of classical cognitive therapy and it is designed to control thinking and mental processes (Kahl et al., 2012; Salmon et al., 2011; Johnson & Hoffart, 2016). It focuses on the treatment of disorders such as worrying, repeated thinking, dysfunctional treat monitoring, and anxiety disorders and it copes with

behaviours that prevent with self-regulation. MCT is based on the Self-Regulatory Executive Function Model while its central concepts are the Cognitive Attentional Syndrome (CAS). It consists of three main elements (Johnson & Hoffart, 2016): a) permanent thinking of worry and rumination, b) focus on threat- perceptions such as emotions, thoughts and sensations, and c) coping behaviours that harm.

MCT is designed for cases that people experience negative thoughts and emotions. Patients suffering from this type of disorders usually activate a specific pattern or thinking style that damages self-regulation and they “ruminate”. MCT is an effective method for the treatment of this type of disorders (Kahl et al., 2012).

### ***3.1.5 Mindfulness Based Cognitive Theory***

Mindfulness Based Cognitive Theory (MBCT) has its origin in meditation techniques of Buddhist medicine (Kahl et al., 2012). It combines practices from mindfulness meditation with cognitive therapy principles. MBCT has been designed for reducing the number of episodes in patients suffering from major depression (Kahl et al., 2012; Churchill et al., 2013).

Its main goal is to teach patients to handle dysfunctional thoughts and experience emotions and cognitions as mental events that may or may not be related to external reality. MBCT activates patients to develop metacognitive awareness and learn how to experience thoughts separated from the self. Actually, it teaches patients to experience thoughts, feelings, and body sensations with an attitude of curiosity and non-judgement (Churchill et al., 2013).

### ***3.1.6 Schema Therapy***

Schema Therapy (ST) is derived from classical cognitive theory and it comprises a wide range of techniques in order to address emotions, behaviours and cognitions of the patient’s present life and related experiences and events from the past. ST was developed for treating personality disorders and various chronic mental disorders (Kahl et al., 2012). It is an integrated psychotherapy and it applies emotion activation techniques from Gestalt and psychodrama in order to communicate a healthy behaviour guide to the patients.

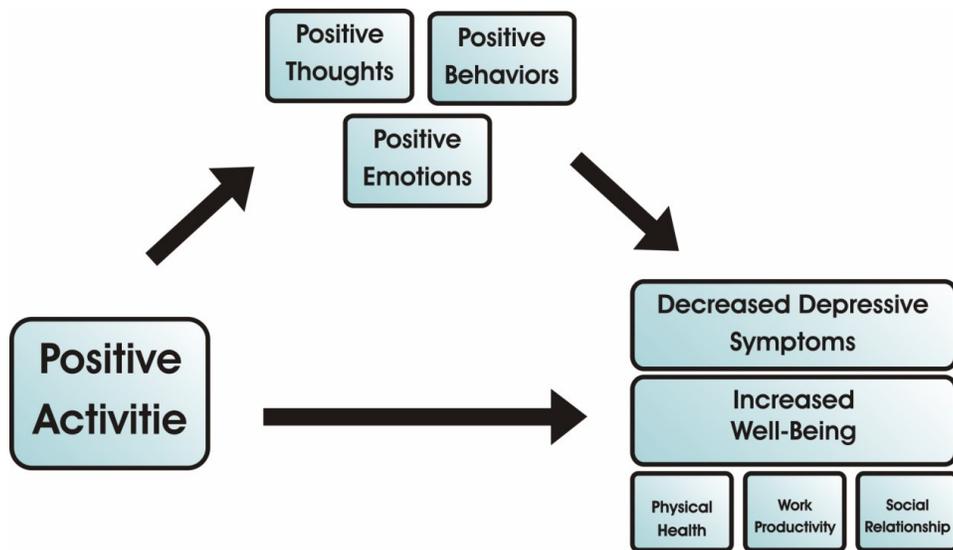
## **3.2 Positive Psychology Interventions**

As previously mentioned, the enhancement of positive emotions is vital in order people to increase well-being and flourish. Many researchers and practitioners in the area of positive

psychology have been studying findings and theories based on positive emotions, well-being and interpersonal relationships enhancement. A promising approach for increasing well-being appears to be Positive Psychology Interventions (PPI) (Schueller & Parks, 2012).

PPIs are intentional activities that aim to increase people’s happiness. Scientists have studied for a long time the behaviours of happy people and proposed exercises containing behaviours and activities that mimic happy people’s behaviours (Schueller & Parks, 2012). More specifically, they have studied why some people are happy, grateful and optimistic on the one hand and how people can learn to be more optimistic and happy on the other (Depressive & Lyubomirsky, 2011). They proposed intentional activities in order to teach people how to think and act in order to be happier. It is worth mentioning that PPIs can also be practiced from happy individuals that want to be happier. The aim of PPIs is threefold: mental health promotion, prevention, and treatment (Barry, 2001; Bolier & Abello, 2014). Sin and Lyubomirsky (2009), as referred by (Koszycki et al., 2010; Villani, Cipresso, Gaggioli, & Riva, 2016), defined PPIs as intentional activities designed to cultivate positive feeling, cognitions and behaviours.

As previously mentioned (see section 2.3 Well Being) experts suggested that the following three factors play a key role to an individual’s well-being: a) the genetic happiness set point, b) the life circumstances and, c) the positive behavioural activities.



**Figure 1:** Schematic diagram which shows how positive activities affect Well-being [17].

In line with this, scientists claim that positive activities may constitute 40% of the individual differences in people’s well-being (Flöttmann, 2016). As a result, practicing intentional activities appears to be a promising method for well-being enhancement, which has

great impact in several areas of our life. The following figure graphically depicts how PPIs affect positive thoughts, positive behaviors and positive emotions in order to enhance well-being and consequently physical health, work procedure and social relationships (Depressive & Lyubomirsky, 2011).

### ***3.2.1 Positive Psychology Exercises***

As already said, PPIs are intentional activities or exercises that are given to the general population for them to practise (Flöttmann, 2016). They can be applied as individual therapy or as group therapy. PPIs are an easy and cheap way to enhance well-being. Seligman, Steen, Park and Peterson (2005) and also Bohlmeijer and Hulsbergen (2013), as referred by (Flöttmann, 2016), developed interventions – exercises for the enhancement of positive emotions. The most popular positive psychology exercises are described in the following subsections.

#### ***3.2.1.1 Character Strengths***

The purpose of exercise “*Character Strengths*” is to enhance character strengths and virtues. In more detail, its aim is for people to learn what character strengths and virtues they possess, to identify the virtues and strengths of their character and use them purposely in order to be happier (Manual et al., 2007). Character strengths are moral virtues such as integrity, fairness, kindness, originality, that are built-up and used purposefully (Manual et al., 2007).

Manual (2007), Lyubomirsky (2013), and Villani (2016), as referred by (Manual et al., 2007; Parks & Seligman, 2007; Villani et al., 2016), described the application of character strength exercise according to definition of Peterson & Park (2009). A list of 24 strengths, grouped into six groups of virtues (“wisdom and knowledge”, “courage”, “humanity and love”, “justice”, “temperance”, and “transcendence”), were given to the study participants and they were asked to identify five of their main strengths. Subsequently, they were asked to use purposefully one or more of them in a new way for one week. Every day they should note which strength of their character they used, how they used it, how they felt before, during and after the activity and whether they plan to repeat it in the future. Studies showed that participants who practised the “*Gratitude Strength*” exercise increased their level of happiness and decreased depressive symptoms compared with the participants in the control group (Schueller & Parks, 2012).

### **3.2.1.2 *Three Good Things***

The aim of the exercise “*Three Good Things*” is to focus on positive events that happen in people’s everyday life and not dwelling on the negative ones (Munson et al., 2010). This exercise aims at increasing happiness and the sense of well-being. Its purpose is to teach people to think and focus in positive experiences rather than to spend time thinking about negative ones.

Lyubomirsky and K. Layous (2013), as referred by (Parks & Seligman, 2007), described the application of the “*Three Good Things*” exercise as a weekly program that asked participants to write down three good things / events that had happened to them each day. Participants should answer the question “Why did this good thing happened?”. The authors applied this exercise to college students and found that it had significant impact in enhancing positive feelings and in improving sleep quality as compared to the students in the control group (Schueller & Parks, 2012).

### **3.2.1.3 *Acts of Kindness***

The aim of the “*Acts of Kindness*” intervention is to activate people to do acts of kindness in their everyday life. When people perform acts of kindness they feel emotions derived from these acts performance. Performing acts of kindness to others, like doing something good for them or saying something kind to them, others return gratitude and kindness towards persons that initially did so (Ouweneel et al., 2014), which in turn, enhances their level of happiness and well-being (Villani et al., 2016) as they feel good about themselves. By cultivating kindness, people are motivated to be kind to others, recognize kindness coming from others and performing actions of kindness in their everyday life (Otake et al., 2006).

Lyubomirsky, Trach and Sheldon (2004), as referred by (Villani et al., 2016), developed an exemplary model of this kind of intervention. According to their model participants committed to five daily kind actions for six weeks. On the other hand, Okate et al. (2006), as referred by (Ouweneel et al., 2014; Manual et al., 2007), proposed that participants should commit acts of kindness for one week. Surveys have shown that acts of kindness have great impact in well-being enhancement (Ouweneel et al., 2014; Villani et al., 2016), especially for women (Otake et al., 2006).

#### **3.2.1.4 Gratitude Expression**

The aim of this intervention is to motivate people to express their gratitude towards others about something good they have done about them (Schueller & Parks, 2012). Gratitude comes from something good that had happened. Gratitude returns to the person good feelings like kindness and improves people's relationships and socialization.

Many ways have been proposed for the application of this exercise. Emmons & McCullough, (2003), Lyubomirsky, Sheldon & Schkade, (2005), as referred by (Villani et al., 2016), suggested that participants should write once a week, for several weeks, five things for which they are grateful. Other authors have proposed that participants should write every night for a week at least three things that they are grateful about. While others have proposed participants to think of a person that they are grateful to and write a letter to this individual expressing their gratitude (Villani et al., 2016; Jones, 2015; Parks & Seligman, 2007). The letter should be specific about what specific action the other person has done and how this action affected the participants' life. Finally, they should deliver the letter and read it aloud.

Studies have shown that the exercise of "*gratitude expression*" leads to positive emotions in other people, like kindness, enthusiasm and inspiration. When people express their gratitude to others or savor positive experience they themselves feel enjoyment and pleasure (Ouweneel et al., 2014; Jones, 2015). The exercise has significant effectiveness in increasing positive attitude and well-being. Park and Peterson (2005), as referred by (Villani et al., 2016), showed that gratitude activities are useful for people suffering from mild to moderate depression.

#### **3.2.1.5 Savoring**

Peterson (2006), as referred by (Villani et al., 2016; Hurley & Kwon, 2012), suggested that "*savoring*" activities are designed to intensify and prolong pleasant experiences. The goal of this exercise is to teach savoring skills and promote their use (Parks & Seligman, 2007; Hurley & Kwon, 2012). While people savor the moment they focus on positive events. In this way they are educated to enjoy and focus on positive events at the present and to identify the positive events in their everyday life too.

Savoring can be used in many ways and in a variety of circumstances. It can be practiced in momentary events like drinking a hot chocolate where people may focus on taste, texture and temperature or when walking by the seaside a sun shining day where people may savor the hot sun, the clean air and the wonderful landscape. One application of this exercise, as reported in

the literature, is to ask participants to savor momentary positive events as described above (Parks & Seligman, 2007; Manual et al., 2007). Another application of this exercise is to ask participants to remember pleasant aspects of their life remembering and savoring details of these moments (Villani et al., 2016). In all cases participants should write every night an essay referring the event and their feelings about the event.

(Villani et al., 2016) showed the effectiveness of savoring activities in increasing positive mood and happiness. When people acquire the skill of savoring they look back in their past in order to identify positive events and they generate positive emotions (Hurley & Kwon, 2012).

#### ***3.2.1.6 Optimistic Thinking***

Seligman (1990), as referred by (Manual et al., 2007), proposed a method in order to teach people develop “*optimistic thinking*” called learned optimism. It is a cognitive behavioral method that focuses on changing people’s explanatory style in making attributions about events (Manual et al., 2007). Its aim is to cultivate an optimistic explanatory style and increase optimistic thinking. Optimistic thinking exercises propose that participants should think all good things happening in their life as permanent and all bad things as temporary.

(Manual et al., 2007) describes an application of this exercise. Participants were asked to write the good and bad events that had happened to them during each day and to note for each event if it was good or bad. If the event was good they should characterized it as permanent, widespread or taking credit to themselves. If the event was bad they should characterize it as temporary, specific or blame other resources. In this way people learn to think more optimistically. Studies have shown that people that think optimistically are happier, have less stress and receive more social support.

#### ***3.2.1.7 You at your best***

Seligman et al. (2005), as referred by (Manual et al., 2007), proposed this exercise in order to boost people’s happiness. The aim of this exercise is to help people build meanings and set goals in their life (Villani et al., 2016). (Villani et al., 2016) claimed that the “*You at your Best*” exercise has therapeutic impact on people because when people think about future objectives they acquire awareness and define their goals.

In this exercise participants are required to envision themselves in the future and think that everything has turned out in the most optimal way possible. Sheldon et al (2006), as referred

by (Villani et al., 2016), suggested that if people visualize this version of their self at least three minutes per day for a week they feel positive emotions and become happier. Additionally, studies have shown that this exercise is a good introductory exercise for well-being enhancement and has long-lasting effects (Manual et al., 2007).

### ***3.2.2 The Efficacy of Positive Psychology Interventions***

Experimental and longitudinal studies have shown that Positive Psychology Interventions contribute to well-being enhancement. Many studies have shown that PPIs are effective for treating depression symptoms (Koszycki et al., 2010; Schueller & Parks, 2012; Flöttmann, 2016; Bolier & Abello, 2014). Watking et al. (2012), as referred by (Watkins et al., 2012), studied the effectiveness of intentional activities as complementary treatment for people suffering from major depression. In detail, they compared the effectiveness of the following therapies: typical biotherapy, typical biotherapy plus relaxation training and typical biotherapy plus intentional activities. They found that typical biotherapy in combination with intentional activities had the greatest impact of all in well-being enhancement.

The literature suggests that it is better to suggest several interventions to people instead of only one, because they can choose the intervention(s) they prefer (Koszycki et al., 2010). These suggestions are reinforced by the findings of Parks et al. (2012), as referred by (Villani et al., 2016), who have shown that people prefer to use a wide variety of positive psychology activities. Moreover, the authors report that offering a variety of interventions has great impact in motivation and adherence (Villani et al., 2016). If people carry out only one activity for a long time it will probably become monotonous and tiring (Villani et al., 2016).

Long term studies in the area of positive psychology have shown that applying an intervention for at least one week increases positive feelings and decreases negative ones. Applying intentional activities for a longer period of time has greater gains in well-being (Koszycki et al., 2010). The key concept of PPIs is to encourage people to integrate intentional activities in their everyday lives. Parks et al. (2012), as referred by (Villani et al., 2016), proposed that people should spend at average an hour per day on purposeful activities in order to increase their happiness.

Also, studies have shown that participants who were selected to participate in a PPI exercise had less gains in WB than participants who voluntary participated (Koszycki et al.,

2010). So, intentional activities are important and people should be motivated to enhance their happiness. It is also worth mentioning that depressed individuals benefit more from PPIs than non-depressed individuals (Koszycki et al., 2010; Depressive & Lyubomirsky, 2011). Probably, this is due to the fact that they are more motivated to be happier.

Additionally participants' culture plays an important role. People from individualist cultures like western cultures, have greater benefits from activities that enhance character strengths and from activities that make them flourish in comparison with people from collectivist cultures who prefer to experience activities which enhance socialization. This is because the criteria about well-being are different. Suh, Diener, Oishi, & Triandis (1998), as referred by (Jones, 2015), report that people from individualistic cultures experience life satisfaction influenced more by intrapersonal than interpersonal factors, whereas people from collectivist cultures do the opposite. Boehm et al. (2011), as referred by (Jones, 2015), studied Anglo Americans and foreign-born Asian Americans who were asked to practise intentional activities. The specific activities were "*Gratitude Expression*" and "*Best Possible Self in Future*". Both activities had good impact on participants as compared with participants in the control group. Anglo Americans experienced the greater satisfaction, while Asian Americans showed slight or no change. This finding may be due to the fact that this type of exercises is not in line with the way people from collectivist cultures experience social harmony and relationships. People from collectivist cultures put community needs before their own needs (Shepherd et al., 2015).

Furthermore, intentional activities influence people according to their character. A study by Schueller (2012), as referred by (Villani et al., 2016), showed that introvert and extrovert people benefit from different interventions. For instance, extroverts have best results from exercises like "*Gratitude Visit*" and "*Savouring*", while introverts benefit more from exercises like "*Character Strengths*" and "*Three Good Things*".

### **3.3 Positive Psychology Technology**

An emerging field in technology, called Positive Technology (PT), investigates how Information and Communication Technologies (ICTs) can be used to empower the quality of personal experience (Stokes, 2014). It is based on applied and theoretical research and studies the connection between Positive Psychological Interventions and the digital world (Villani et al., 2016; Botella et al., 2012a). PT is used for enhancing wellness and generating strength and

resilience in individuals, organizations, and societies. Additionally, it used by scientists for collecting and analysing information as far as concern the personal experience (Villani et al., 2016). Positive psychology has taken advantages of many of the possibilities offered by ICTs in order to manipulate and enhance the features of personal experience (Riva, 2012).

Nowadays people use technology to communicate, enjoy and search for information. Hence, PT can be used as a means to influence people's individual and interpersonal experiences by fostering positive emotions and enhancing social integration and connectedness (Stokes, 2014). Likewise, evidence suggests that the use of technology can help people to experience emotions, communicate with others, cultivate virtues and engage into positive behaviours and positive functioning (Botella et al., 2012b).

Cognitive and Positive Psychology have defined three determinants of personal experience: the emotional quality, the engagement / actualization and the connectedness. Similarly, Positive Technologies are categorized according to their effect in personal experience (Villani et al., 2016; Botella et al., 2012a; Riva, 2012) in the following categories:

- Hedonic (Emotional Quality): Includes all technologies used by individuals or groups for fostering positive emotional states.
- Eudemonic (Engagement / Actualization): Includes all technologies that support people to have engaging and self-actualizing experiences.
- Social /Interpersonal (Connectedness): Includes all technologies used for improving social integration and connectedness between individuals, groups and organizations.

In the following subsections we will briefly review the main categories of modern ICTs used for the support of Positive Psychology interventions.

### ***3.3.1 Online Interventions***

As it was previously mentioned only a small portion of people who have mental health problems have access in medical health system. In industrialized countries the percent of people who receive the most appropriate treatment from the health care system varies from 7% to 25% (Versluis, Verkuil, Spinhoven, Van Der Ploeg, & Brosschot, 2016). As a result, there is a need to enhance the access to the health and social care system. One solution to this problem is the creation of non-consumable interventions that can be used repeatedly without being exhausted (Flöttmann, 2016). Hence, the Internet and Information and Communication Technologies

(ICTs) represent excellent means for delivering self-help well-being interventions. Scueller and Parks (2012), as referred by (Flöttmann, 2016), suggested that positive exercises approaches delivered via internet are better than interventions based on face-to-face approaches as far as concern the stigmatization of the individuals.

Today positive technology offers many online and offline methods for self-management and self-care assessment (Versluis et al., 2016). Online computerized programs based in Cognitive Behavioral Therapy (CBT) are delivered through internet (Watkins et al., 2012). Computerized CBT programs offer a package of interventions and use instant messaging in order to offer guidance for self-help to patients (Watkins et al., 2012). There is a variety of applications offered. Such approaches are key elements for improving the access to psychological treatment. The UK was the first that offered many variants of CBT programs that focus on psychoeducation and treatment from distance without the need for face-to-face meetings (Watkins et al., 2012). This type of interventions have become more and more popular as they motivate people to take control of their own health and well-being (Bolier & Abello, 2014).

Additionally, Internet and ICTs support many studies focusing on the application and effectiveness of the various proposed methods in the field of Positive Psychology. One of the first studies for accessing the efficacy of different PPIs was carried out over internet (Villani et al., 2016). Internet Based Cognitive Behavioral Therapy and other interventions that study the intrapersonal and interpersonal skills are burgeoning (Calvo & Peters, 2012).

### ***3.3.2 Social Media***

Social media are internet based technologies that allow the connection of people around the world where they can share information, ideas, interests etc. via virtual communities. People can create their profile and they can interact with other individuals or groups. By connecting in social media, users can also save content like digital photos, videos, information and data generated from the online interaction with other peers. Social networks are like a “global village” which connects millions of people who don’t know each other but who influence each other (Botella et al., 2012a). User profiles are designed in such way that helps users to build their digital personal identity and present themselves to the world (Villani et al., 2016).

Social networks enable users in becoming part of a community and share ideas and goals. As shown in various studies, the feeling of “being in the world with others” can be a powerful

tool for motivating people exchange knowledge, ideas, plans and goals (Botella et al., 2012a). Positive Psychology can use social media for fostering participants to help other members of the virtual community. Thus, the contribution of social media could be essential.

Riva and colleagues (2010), as referred by (Riva, 2012), suggested that the scope of communication of a virtual group can put its own intentions into practice. Additionally, by reading the subject of a virtual group the intentions of group members are understandable. This implies that, joining in a virtual community gives users the opportunity to express their selves, get ideas, understand what each individual member is doing and develop positive relationships with others. In turn, Ryff and Singer (2000), as referred by (Riva, 2012), reports that the development of positive relations with other people plays a key role for their well-being and this finding is applicable across different cultures and across time.

Positive Psychology suggests that the integration of wellness applications into an existing social network with a large and active membership can contribute to the widespread of health interventions. For instance, Seligman et al. (2009), as referred by (Munson & Resnick, 2012), have developed an application called “3GT” and deployed it in Facebook. 3GT supports the “*Three Good Things*” exercise in order to promote psychological well-being. Users can post their good actions and share them with the friends they already have in Facebook (Munson & Resnick, 2012).

### **3.3.3 *Serious games***

Serious games (SG) are examples of gaming that have been designed for a specific purpose other than pure entertainment<sup>1</sup>. They are used for many purposes including educational, health and wellness care, city planning, engineering etc. Serious games are based on a textual environment enriched by clips, images and animated graphics which make them more interactive (Stokes, 2014). Many of them have been developed based on computerized cognitive behavioral therapy.

Merry et al. (2012) and Shandley, Austin, Klein, & Kyrio (2010), as referred by (Fleming et al., 2014), discuss the potential contribution of SGs in mental health interventions, as reported in. Additionally, Connolly, Boyle, MacArthur, Hainey, & Boyle (2012) and Papastergiou (2009), as referred by (Fleming et al., 2014), pointed out that well-designed computer games have

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<sup>1</sup> <http://www.igi-global.com/dictionary/serious-games/26549>

multiple benefits such as improving attention and adherence to treatments, increasing social engagement, and enhancing well-being. SGs provides feedback to users which can be an effective tool for behavioral change (Fleming et al., 2014).

Also, serious games offer opportunities to increase computerized therapies for depression treatment. They integrate intentional activities which are designed to reduce and / or to prevent depression (Fleming et al., 2014). They can be good treatment methods especially for those who are particularly sensitive to criticism or rejection in order to acquire skills in a non-threatening context considering that choices are associated with clear outcomes (Fleming et al., 2014).

There are lots of SGs designed for depression and well-being enhancement. SPARX is a SG designed for treating young people suffering from mild to moderate depression (Riva, 2012; Shepherd et al., 2015). It is based on Cognitive Behavioral Therapy and supports patients and their families. Studies applied in indigenous adolescents “Maori” in New Zealand showed that it was an effective treatment method acceptable from adolescents, families and society (Shepherd et al., 2015).

### ***3.3.4 Virtual Reality Systems***

Virtual reality systems use technology to create artificial environments, designed in a way that appears like a real environment (Katz et al., 2006). The combination of appropriate hardware and software produces well-designed graphical interfaces containing avatars and personas for simulating the real world. Virtual reality systems make users feel that they actively participate in virtual events or world, simultaneously engaging their mind and body. They focus on activating people to learn, solve problems, achieve goals, enjoy etc. (Katz et al., 2006).

Positive Psychology employs virtual reality systems to encourage users to join in groups and play an active role in order to increase their well-being (Muuraiskangas et al., 2012). Virtual coaches or personas teach users things such as how to initiate and maintain meaningful and enduring relationships, how to think positively, and how to perform specific actions (Muuraiskangas et al., 2012; Albaina, Visser, van der Mast, & Vastenburg, 2009). Virtual coaches are designed according to the target group. The users are represented by a graphical entities called avatars (Katz et al., 2006; Muuraiskangas et al., 2012; Ahtinen et al., 2009).

Users through virtual reality systems can create wellness profile with avatars showing their interests, their goals etc., in order to communicate with other peers with similar interests or

join in virtual groups and interact with others in order to achieve common goals (Ahtinen et al., 2009). In any case, participants have the sense of belonging into a community where they can express their selves (Muuraiskangas et al., 2012; Albaina et al., 2009). Riva and colleagues (2006), as referred by (Riva, 2012), have shown that most virtual reality applications, in the area of positive psychology, based on a strategy defined as “transformation to flow” which is an optimal experience induced by technology and promotes new psychological resources and resources of involvement.

### ***3.3.5 Crowd Powered Positive Psychology Interventions***

Crowdsourcing is a specific online sourcing model which interconnects individuals or organizations in order to contribute for meeting needs, obtaining services or ideas. Crowded powered systems can be used to enhance technological interventions for Positive Psychology (Morris & Picard, 2014). Scheuller, Munoz & Mohr (2013), as referred by (Morris & Picard, 2014), proposed that crowd-sourcing approaches could be used for self-guided behavioral interventions in order to reach underserved populations that might not otherwise have the resources to traditional therapist-led interventions.

Crowdsourcing systems are well-suited for positive psychology behavioral interventions because they can offer on-demand assistance to participants that need help and also boost adherence and sustained engagement. Reivich, Gillham, Chaplin & Seligman (2013), as referred by (Morris & Picard, 2014), proposed that this approach could help individuals apply “realistic optimism” when they experience stressful situations. This could be done if a participant sends a message referring the reason why he/she feels stressed and the other participants sends him/her messages reporting the best-case or worse-case scenario. The other person’s ideas may change participant’s feelings about the event because the other is distanced from the situation, so he/she may be better generating spontaneous and clever ideas. In the same way, crowdsourcing systems could be applied in order to help participants to use their personal strengths, to perform acts of kindness, etc. (Morris & Picard, 2014).

### ***3.3.6 Mobile Interventions***

Mobile phones are ubiquitous. Studies have shown that 91% of Americans have cell phones and 61% of those are smart phones (Konrath, 2014). Smartphones are clever mobile phones that function like personal computers. Smartphones contain tools such as calendar,

calculator, address book, word clock, and note pad, email apps, internet browser and have sensors. The first smartphone was designed by IBM in 1992 and was released in 1993 (Handel, 2011).

Apps are applications designed specifically for smartphones. In December 2008 there were over 10,000 third party apps available for the iPhone. During the first weakened ten million downloads were conducted (Handel, 2011). It is obvious why researchers and clinicians coming from various fields, including medicine and psychology, have considered smartphones as potentially powerful intervention tools.

Mobile phone interventions are electronic tools that include text messages and apps and focus on improving physical or mental health (Konrath, 2014). It also called e-health or mHealth. Kay, Santos, & Takane (2011), as referred by (Konrath, 2014), defined mHealth as applications that use mobile and wireless technologies in order to support the achievement of health objectives. During the last decades, there has been plethora of studies in the area of mobile phone interventions in order to improve health outcomes. Also, one recent review conducted by Fiordelli et al. (2013), as referred by (Konrath, 2014), mentioned that the potential of smartphones does not seem to have been fully explored yet because most of these studies have been conducted in Europe and North America.

Smartphone based interactions have advantages such as the potential for massive intervention delivery and for massive data collection. They offer interaction between participants, patients, and researchers, clinicians (Konrath, 2014). Smartphones can collect a wide range of data like texts, heart rate, movements via accelerometers, location via GPS, language information, visual information and data produced from conversations with others. Additionally, smartphones provide mobility and online connection almost everywhere and support social interaction increasing motivation towards wellness activities (Ahtinen et al., 2009).

Although, scientists use mobile technology in order to develop innovated approaches for helping individuals to enhance mental health, well-being and social relationships they have some disadvantages too. One of these is the difficulty in analyzing the massive amount of data collected from mobile interventions. It is also difficult to recruit certain populations for the purpose of a study. Certain population, like children, may not have access to mobile phones.

Clinicians and researchers have minimal control in the environment of the participants. Finally, there are ethical issues such as the security of their personal data.

### **3.4 Mental Health Apps**

Mental health apps are mobile applications that offer the user self-management and support tools. They are innovated and effective resources and offer health information to patients, researcher, clinicians and organizations. They are advantageous approaches especially for those who don't have access to mental health services because of low income (Lund et al., 2011), insurance status, limited available time, stigmatization etc. (Konrath, 2014).

Mental health apps are designed to interact directly with patients with or without the presence of a healthcare professional. They provide personalized information in order to help patients to take control of their healthcare (Handel, 2011). In other words, these are patient centered healthcare models that encourage patients to be actively involved in their treatment of increasing well-being.

Over the past 30 years, scientists have taken into consideration the difficulties of self-management such as low adherence to treatment guidelines, low quality of life and poor psychological well-being. Additionally, they have been studying the development of innovative Interactive Health Communication Applications (IHCA) (Handel, 2011). IHCA focuses on how to increase patients' involvement in their treatment and how to decrease the negative effects of illness in their everyday life. IHCA designers were studying ways for cultivating positive cognitive, behavioral, emotional and social attitudes to the patients. The development of IHCA for Smartphone is an ideal solution for many reasons. Mobile apps are easily accessible, of a low cost, connected to internet and used in everyday life.

Actually, the main aim of mental health apps is to teach patients or users to change their health's behaviors. An additional aim is to turn the new behaviors into habits (Versluis et al., 2016). For example people under stress have goal directed behaviors and produce negative thoughts, so apps teach them to change the way they think in order to relax and think more positively.

Apps should be conformed in certain principles in order to be qualitative and more attractive to users than traditional treatments. These principles can be grouped into the following categories:

- Proposed interventions should be based on high quality research and strong theoretical background (Flöttmann, 2016).
- To be designed according to target group needs taking in consideration mental and physical limitations, age, culture, etc. (Muuraiskangas et al., 2012). For example, if the target group is children, app should be designed according to their interests and capabilities and children's understanding of the conceptual principles (e.g. what children can conceive as gratitude) (Yarosh & Schueller, 2017).
- To have prompts and reminders such as notifications, messages, and emails in order to be informative and give feedback to the users (Bolier & Abello, 2014).
- To set clear goals to the users and give them instructions on how to achieve this goals (Bolier & Abello, 2014).
- To share content with others anonymously. Sharing content with other peers make users more motivated because they take ideas from others and feel more involved (Bolier & Abello, 2014; Muuraiskangas et al., 2012; Albaina et al., 2009).
- To be user friendly and follow the usability principles (e.g. simplicity, easiness of navigation, aesthetic appropriateness, and comprehensive information) (Bolier & Abello, 2014; Muuraiskangas et al., 2012).
- To collect data in order to obtain diary reports proper for data analysis (e.g. interval, signal and event-contingent) (Bolger, Davis, & Rafaeli, 2003; Albaina et al., 2009; Hayden, 2016).

Mental health Apps focus on reducing mental health symptoms, such as depressive symptoms (e.g. hopelessness, and anger), anxiety symptoms (e.g. exaggerate response to threatening stimuli), schizophrenia symptoms (e.g. hallucinations, and delusions) or to enhance well-being (e.g. interventions for kindness, gratitude, and hope) or to improve people's social relationships (Konrath, 2014).

Reading the literature it is obvious that Information and Communication Technologys have contributed to the widespread and the application of Positive Psychology Interventions for well-being enhancement. As we mentioned previously (section 3.3.1), internet based

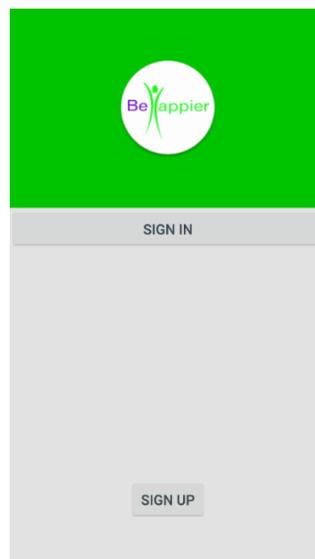
applications offers non-consumable interventions that can be used repeatedly without being exhausted (Munoz, 2010; Flöttmann, 2016). Likewise, social media connects millions of people who influence each other (Botella et al., 2012a). Users can join in groups with other peers who have common goals. Each user can present their self in a virtual community through his/her profile. Additionally, mobile phone interventions offer a number of advantages (see section 3.3.6) because mobile phones are ubiquitous (Konrath, 2014). Especially smartphones which are clever electronic devices and contain tools such as internet connection and multimedia tools support. Plethora of mental health applications are developed for smartphone platforms because of the advantages they offer.

The findings from the literature justified the objectives of this Thesis which is to develop a novel Positive Psychology app which combines smartphone applications advantages (e.g. mobility and internet connection) and social media advantages (e.g. joining into group) while provide privacy and it is based on strong theoretical background.

## 4 Technical Implementation

The technical implementation refers to the development of an android application called “*BeHappier*” (see *Figure 2*). The objective of the “*BeHappier*” app is to help individuals to improve their well-being and increase their life satisfaction. It is ideal tool for those who don’t have time or don’t like reading self-helped books and it can help all population groups and especially those who suffering from mild to moderate mental health disorders such as depression and anxiety. It can be used every ware and anytime.

*BeHappier* is a scientifically-based smartphone application based on Positive Psychology. It consists of two (2) modes. The first mode (Group1) contains a verity of widely used and respected questionnaires and asks to users to complete them in regular basis in order to measure their happiness level. Additionally, this mode contains six (6) self-helped exercises/activities that focus on decreasing users’ stress and depression while at the same time increase their happiness and wellbeing level. In the second mode (Group 2), it provides the same questionnaires with the first mode and asks to users to complete them in the same basis as in first mode. Users have to choose one of this modes and they cannot change mode after they have chosen one.



**Figure 2:** “*BeHappier*” App

In both modes, the app asks to uses to complete questionnaires to assess their general happiness level and feeling such as hope, optimism, and gratitude and give them track of their happiness level through graphs and absolute values. It also offers instructions and reminders. Each time

users login, and every 4 hours if application runs, they take personalized notifications that inform them what is the next task they have to do. Furthermore, it offers to users joined in the first mode, the opportunity to share their activities with other peers that use the application and see what the others have posted.

## **4.1 Theoretical Background**

The program of exercises is based on the principles of Positive Psychology. As already said earlier, Positive Psychology does not focus on psychopathology, in disorders and problematic aspects of human existence, but on abilities, virtues, talents (Stalikas, 2011) and the achievement of a life full of satisfactions (Seligman & Csikszentmihalyi, 2000).

Seligman (2002), as referred by (Stalikas, 2011), argued that people can increase prosperity and happiness through intentional activities / exercises that are aimed at cultivating positive emotions, behaviors, and / or thoughts. Other scientific studies have shown that exercises based on Positive Psychology are effective for enhancing people's well-being and improving the depressive symptoms and anxiety symptoms (Bolier et al., 2013).

Number of studies have supported that the improvement of welfare benefits the individual in many fields:

Personally: Incensement of life satisfaction and happiness, improvement of mental health improvement of physical health (Wood & Joseph, 2010; Keyes, Dhingra, & Simoes, 2010; Shannon M Suldo & Shaffer, 2008; Pressman & Cohen, 2005),

Social: High quality relationships with family and friends, fewer social problems (Bolger et al., 2003).

Academic: The incensement of well- being and the related factors (e.g., resilience) can act as a protective agent against occurrence of adverse effects such as mental illness, and school failure (Ouweneel et al., 2014; S. M. Suldo, Riley, & Shaffer, 2006).

## **4.2 The Application Process Flowchart**

The steps of the application are illustrated as a flow chart in *Figure 3* . Here, the flow chart and the main processes of the application are described in the following list. Analytical description of application processes are presented in section 4.4.

- Sign Up: The first time the application runs in users' devise it asks to users to Sign up giving their e-mail and a password.

- Login: Users in order to login in the application they are asked to enter the e-mail and the password they entered during Sign up process.

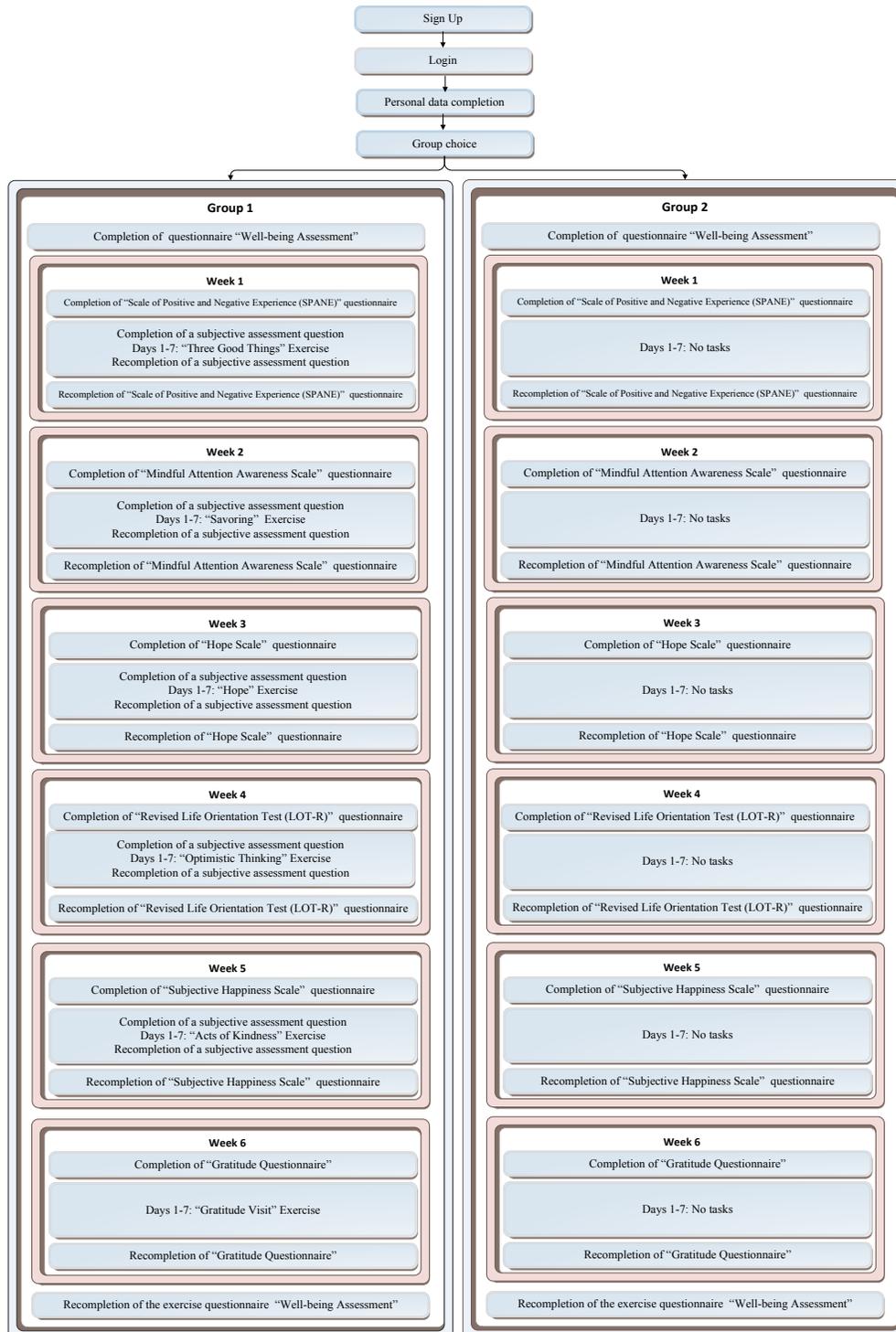


Figure 3: Application Process Flowchart

- Personal data completion: Users are asked to enter their personal data. The completion of data such as nickname, age and sex are required while data such as full name, educational level, employment, marital status and incomes are optional.
- Group choice: Users are asked to choose the group they prefer to join in. *Group 1* members are asked to complete questionnaires, in order to take feedback about their well-being level, in a regular basis while they are asked to do six positive psychology exercises in order to improve their well-being level. *Group 2* members are asked to complete questionnaires, in order to take feedback about their well-being level, in a regular basis.

**Group 1 process flow description:**

- Main questionnaire completion – Baseline Assessment: Users are asked to complete the main questionnaire so the application will give them information about their happiness level before they start using the application. Main questionnaire encompasses the following four questionnaires: a) Psychological Well-Being, b) Life Satisfaction Scale, c) Brief Symptom Inventory-18, and d) Flourishing Scale.
- Exercise 1 (Week 1): Execution of the exercise called “Three Good Things”, which aims to educate users to focus on good things or events that happens in their everyday life. The duration of the exercise is seven (7) days. The work flow chart of the exercise is the following:
  - Completion of the exercise questionnaire, called “*Scale of Positive and Negative Experience (SPANE)*”.
  - Completion of a subjective assessment question.
  - Days 1-7: For each day and within 48 hours, users are asked to note at least three (3) good things or events that had happened to them during the day.
  - Recompletion of a subjective assessment question.
  - Recompletion of the exercise questionnaire, called “*Scale of Positive and Negative Experience (SPANE)*”.
- Exercise 2 (Week 2): Execution of the exercise called “Savoring”, which aims to educate users to focus and savor the pleasures coming from small or large thing or events that happens in their everyday life. The duration of the exercise is seven (7) days. The work flow chart of the exercise is the following:

- Completion of the exercise questionnaire, called “*Mindful Attention Awareness Scale*”.
  - Completion of a subjective assessment question.
  - Days 1-7: For each day and within 48 hours, users are asked to note at least two (2) pleasures that they had savored during the day.
  - Recompletion of a subjective assessment question.
  - Recompletion of the exercise questionnaire, called “Mindful Attention Awareness Scale”.
- Exercise 3 (Week 3): Execution of the exercise called “Hope”, which aims to educate users to think positive and practice hopeful thinking for their future. The duration of the exercise is seven (7) days. The work flow chart of the exercise is the following:
    - Completion of the exercise questionnaire, called “*Hope Scale*”.
    - Completion of a subjective assessment question.
    - Day 1: within 48 hours, users are asked to write down about how they imagine their best possible self in the future.
    - Days 2-7: Entries are optional. Although, the app suggests to users to complete new features that they would like to add in their best possible self in the future.
    - Recompletion of a subjective assessment question.
    - Recompletion of the exercise questionnaire, called “*Hope Scale*”.
- Exercise 4 (Week 4): Execution of the exercise called “Optimistic Thinking”, which aims to increase the use of optimistic thinking to users and teach them how to experience both the bad/negative events and the good/positive ones more optimistically. The duration of the exercise is seven (7) days. The work flow chart of the exercise is the following:
    - Completion of the exercise questionnaire, called “*Revised Life Orientation Test (LOT-R)*”.
    - Completion of a subjective assessment question.
    - Days 1-7: For each day and within 48 hours, users are asked to note at least one (1) event that happened to them during the day and whether it was a good (positive) or bad (negative). Then they should write one optimistic thought next to the event.

- Recompletion of a subjective assessment question.
- Recompletion of the exercise questionnaire, called “*Revised Life Orientation Test (LOT-R)*”.
- Exercise 5 (Week 5): Execution of the exercise called “Acts of Kindness”, which aims to educate users to consciously perform acts of kindness in their daily life in order to increase their happiness. The duration of the exercise is seven (7) days. The work flow chart of the exercise is the following:
  - Completion of the exercise questionnaire, called “*Subjective Happiness Scale*”.
  - Completion of a subjective assessment question.
  - Days 1-7: For each day and within 48 hours, users are asked to note at least three (3) acts of kindness they have done during the day.
  - Recompletion of a subjective assessment question.
  - Recompletion of the exercise questionnaire, called “*Subjective Happiness Scale*”.
- Exercise 6 (Week 6): Execution of the exercise called “*Gratitude Visit*”, which aims to encourage users to acknowledge something good that a person has done for them, for which they have never had the chance to properly thank that person for. The duration of the exercise is seven (7) days. The work flow chart of the exercise is the following:
  - Completion of the exercise questionnaire, called “*Gratitude Questionnaire*”.
  - Day 1 - Step 1: within 48 hours, users are asked to note the person they would like to write the letter for.
  - Day 2 - Step2: within 48 hours, users are asked to note if they have written the letter.
  - Day 3 – Step3: within 48 hours, users are asked to note if they have given and read the letter to the person they have chosen.
  - Days 4-7 - Step 4: Users are asked to answer the following questions: a) “How did you feel as you wrote the letter?”, b) “How did you feel when you delivered the letter?”, c) How did the other person react to your expression of gratitude?”, and d) “Did his/her reaction influence you and how?”.
  - Recompletion of the exercise questionnaire, called “*Gratitude Questionnaire*”.

- Main questionnaire completion – Measurement 1: Users are asked to recomplete the main questionnaire so that the application will give them information about their happiness level after they have done all the proposed exercises. As we mentioned previously, the following four questionnaires are the main questionnaires used: a) Psychological Well-Being, b) Life Satisfaction Scale, c) Brief Symptom Inventory-18, and d) Flourishing Scale.

It should be noted that after users have completed each exercise they can add new entries, if they so wish, in a manner similar to what they used to do during the days 1 to 7, without any limits. In each exercise there is a card called “More Entries” for this purpose. Additionally, they can continue to complete the main questionnaire (measurements 2-12) once a month, for twelve (12) months, in order to measure their happiness level.

**Group 2 process flow description:**

- Main questionnaire completion – Baseline Assessment: Users are asked to complete the main questionnaire so the application will give them information about their happiness level before they start using the application. Main questionnaire encompasses the following four questionnaires: a) *Psychological Well-Being*, b) *Life Satisfaction Scale*, c) *Brief Symptom Inventory-18*, and d) *Flourishing Scale*.
- Week 1: The work flow chart of the first week is the following:
  - Day 1: Completion of the exercise questionnaire, called “*Scale of Positive and Negative Experience (SPANES)*”.
  - Day 7: Recompletion of the exercise questionnaire, called “*Scale of Positive and Negative Experience (SPANES)*”.
- Week 2: The work flow chart of the second week is the following:
  - Day 1: Completion of the exercise questionnaire, called “*Mindful Attention Awareness Scale*”.
  - Day 7: Recompletion of the exercise questionnaire, called “*Mindful Attention Awareness Scale*”.
- Week 3: The work flow chart of the third week is the following:
  - Day 1: Completion of the exercise questionnaire, called “*Hope Scale*”.
  - Day 7: Recompletion of the “*Hope Scale*” questionnaire.

- Week 4: The work flow chart of the fourth week is the following:
  - Day 1: Completion of the exercise questionnaire, called “*Revised Life Orientation Test (LOT-R)*”.
  - Day 7: Recompletion of the exercise questionnaire, i.e. “*Revised Life Orientation Test (LOT-R)*”.
- Week 5: The work flow chart of the fifth week is the following:
  - Day 1: Completion of the exercise questionnaire, called “*Subjective Happiness Scale*”.
  - Day 7: Recompletion of the exercise questionnaire, i.e. “*Subjective Happiness Scale*”.
- Week 6: The work flow chart of the sixth week is the following:
  - Day 1: Completion of the exercise questionnaire, called the “*Gratitude Questionnaire*”.
  - Day 7: Recompletion of the exercise questionnaire, i.e. the “*Gratitude Questionnaire*”.
- Main questionnaire completion – Measurement 1: Users are asked to complete again the main questionnaire so that the application will give them information about their happiness level after they have answered all the above questionnaires. As we mentioned previously, main questionnaire encompasses the following four questionnaires: a) Psychological Well-Being, b) Life Satisfaction Scale, c) Brief Symptom Inventory-18, and d) Flourishing Scale.

It should again be noted that users can continue to complete the main questionnaire (measurements 2-12) once a month, for twelve (12) months, in order to measure their happiness level.

### 4.3 Technologies and Tools

*Be Happier* is a full material design app (“Material\_Design @ en.wikipedia.org,” 2017; “Material design,” 2017), developed in Java programming language (“Learn Java for Android Development: Introduction to Java,” 2010). Modern navigation tools and material design elements such as scrolling tabs, navigation drawers, and floating action buttons (FAB) menus, provide a simple and usable navigation. *Be happier* app stores its data in cloud in a base called

Firestore. Firestore is a real time database and makes synchronization with every connected client. The app reads and writes all information, including menu indications, from the cloud database. So, users have feedback from any change in the base within milliseconds. Also, Be Happier app let users to authenticate with Firestore using their email addresses and a password that they have declared in sign up during their first contact with the application.

### ***4.3.1 Android SDK***

Android SDK (Software Development Kit) are tools necessary for the creation, testing and debugging Android apps. Android's main website provides free download for SDK tools and support and compatibility libraries to developers. SDK tools and libraries are necessary tools for the development of mobile apps including code editing, debugging, testing, and profiling tools. Android libraries provide specification for the use of multitasking, drag and drop and swiping between screens. Android Studio is a platform designed especially for Android apps development in Java language ("Index @ Developer.Android.Com," 2017.; Hong, 2015).

### ***4.3.2 Java Programming Language***

Java is a concurrent, class-based, object-oriented general purpose computer programming language. Java is the language used to develop Android apps. Additionally it is designed to platform-independent and secure, using virtual machines. Android SDK includes many standard Java libraries such as data structure libraries, math libraries, graphics libraries, networking libraries and everything else you could want that help developers to build the app. So, the recommended method for most developers is to write native apps using Java and the Android SDK ("Learn Java for Android Development: Introduction to Java," 2010).

### ***4.3.3 Firestore for Android***

Firestore is a cloud-hosted database. It evolved from by Andrew Lee and James Tamplin in 2011 and in October 2014 it was acquired by Google ("Firestore @ en.wikipedia.org," 2017). Firestore is real time database. Data are saved in JSON format. It is developed for storing data from Android, iOS, and Web Services applications. It can be accessed directly from mobile device or web browser using Google authentication or directly from client side code. Security and data validation rules are provided called "Firestore Realtime Database Security Rules" for

the database structure and security configuration. Developers use these rules to define the structure of the database and to determine who has access to read and write in database.

Firebase is a realtime database and makes synchronization every time data change. Connected users receive updated data within milliseconds. Additionally, Firebase SDK tools make copy of accessed data to user's disk, so even if user's device loses connection to Firebase, user can read and write, giving him/her a responsive experience. When user's device regains connection, Firebase synchronizes the local data changes with the remote updates that occurred while device was offline. Also, it resolves any conflicts automatically (Firebase, 2017; "Firebase Realtime Database," 2017).

#### ***4.3.4 Material Design***

Material Design is a designed language developed by Google in 2014 ("Material\_Design @ en.wikipedia.org," 2017). It contains the overarching schemes, styles and architectural principles for designing and developing applications. Additionally, material design includes complete guidance for visual, motion and interaction design. Android includes support for material design providing themes, widgets for complex views, and APIs (Application Program Interfaces) for custom shadows and animations. Material design focuses on synthesizing the classic principles of good design with the innovation of technology and science. In detail, it proposes usable elements of print-based design, typography, grids, space scale, color, etc. designed in such a way that not only are please the eye but also create hierarchy, meaning and focus. Surfaces and edges are provided with visual cues that are grounded in reality. Motions and shadows seem like in real world. Furthermore, motion and actions are designed in such a way to focus attention and maintain continuity ("Material design," 2017).

#### ***4.3.5 Software Used***

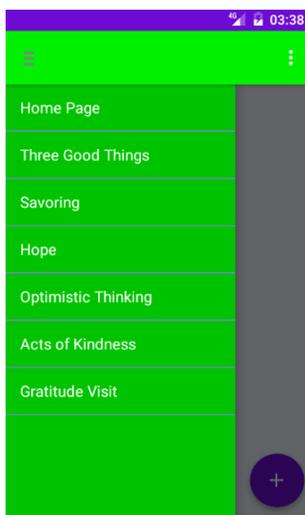
Software used for the development of the mobile app "Be Happier":

- **Android Studio Version 1.5.1:** Android Studio is the official Integrated Development Environment for the development of android applications. It includes SDK tools, a reach layout XML editor proper for building screens layout, options to preview layouts and android virtual devices in order to run and debug apps.
- **Android Asset Studio:** It is an Online Icon Generator. It helps users to create icons at different densities.

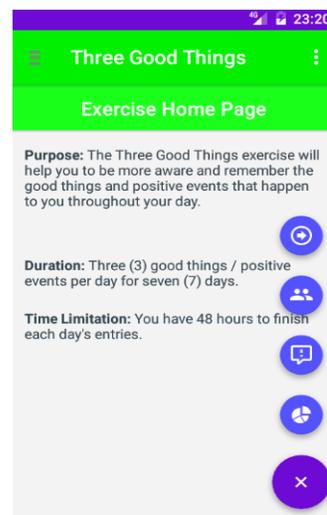
- **Genymotion Android Emulator** (Personal use edition): It is an Android emulator which comes with pre-configured Android (x86 with OpenGL hardware acceleration) images, suitable for application testing.
- **Online Firebase Console:** It is used to handle the database of the application. It provides a complete set of tools in order to structure the data, to view containing data, to configure rules, to see the usage of the base, to backup, and to extract the database. Additionally, it contains authentication tools. An overview of “BeHappier” database is presented in Appendix A.
- **Online JSON Editor:** It is a web based tool which contains options to load, view, edit, format and save JSON files.
- **Google Chrome – Mozilla Firefox:** Web browsers used for access to Firebase console and online JSON editors.

#### 4.4 Positive Psychology Exercises Description

In the following subsections are described in detail the Positive Psychology Exercises which contained in the application. There is a navigation drawer menu for exercise to exercise navigation (see *Figure 4* ). Each exercise consists of the following five (5) pages, home page, instructions, statistics, shared entries and data entrance page. While, each exercise has a floating action button menu for the navigation from page to page within the exercise (see *Figure 5*).



**Figure 4:** Exercises Navigation Drawer Menu



**Figure 5:** Exercise Floating Action Button Menu

### 4.4.1 Three Good Things Exercise

The objective of *Three Good Things exercise* is to help users to be more aware and remember the good things and positive events that happen to them throughout the day (Munson et al., 2010). Its aim is to teach users to think and focus in positive experiences (Parks & Seligman, 2007). The performance of this exercise increases users' happiness level and the sense of well-being (Seligman, Steen, Park, & Peterson, 2005).

Home page of the exercise describes the purpose, the duration and the terms of the exercise as shown in *Figure 6*. A brief description of the purpose shows to users the aim of the exercise. Additionally, this page informs users that the duration of the exercise is seven (7) days and that they have to enter at least three inputs within forty eight (48) hours describing the good things or positive events that had happened to them during the day.

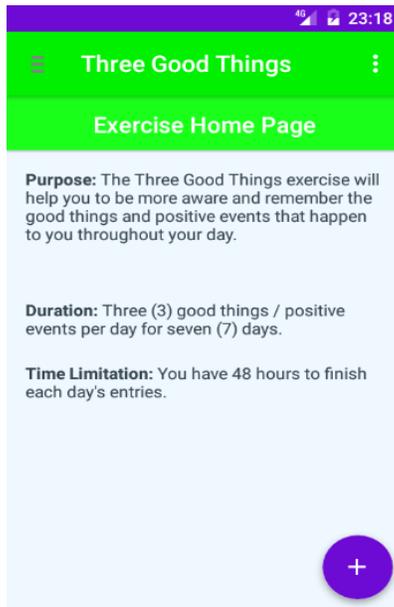


Figure 6: Exercise Home Page

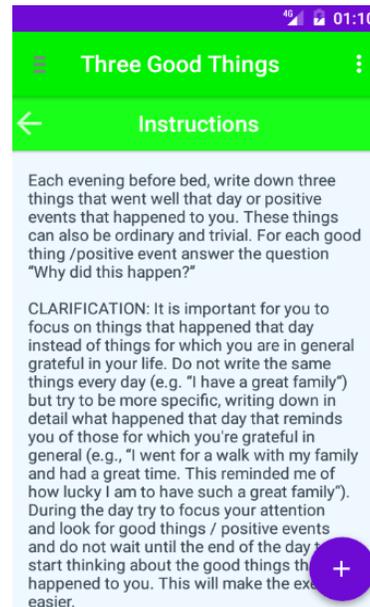


Figure 7: Instruction Page

Instruction page gives to users' detailed information about what they have to do. It asks them each evening before they go to bed to write down three things that went well during the day or positive events that happened to them. It explains that these things can be ordinary and trivial. Additionally, it asks the users to answer why this good thing / positive event happened. Furthermore, it gives clarifications to users, pointing out that it is important to focus on things

that happened during that day instead of things for which they are in general grateful in their life and suggests them to be specific. Instructions page can be seen in *Figure 7*.

When users start the exercise, they are asked to complete the exercise questionnaire, called “*Scale of Positive and Negative Experience (SPANE)*” (layouts like *Figure 19*, *Figure 20*, *Figure 22*). Then they are asked to answer a subjective assessment question. In detail users are asked to rate, on a scale from 0 to 10, the frequency that good things and positive events happen in his/her life. "0" stands for "never/rarely", "5" stands for "sometimes" and "10" stands for "always/very often" (layout like *Figure 21*). Subsequently, users have to complete 3 good things or positive events that had happened to them during that day.



**Figure 8:** *User entries –Day1*

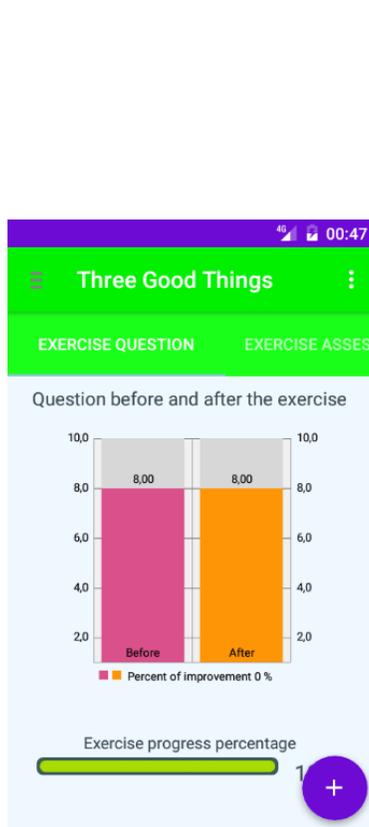


**Figure 9:** *Shared Entries*

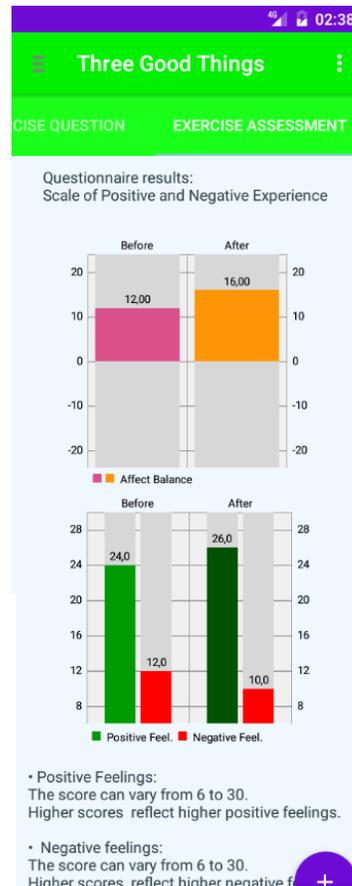
Users can share the post with others if they like (layout like *Figure 23* ). In each day users can see the posts they have entered, including information such as if the posts are shared or not and the date and time each post entered (see *Figure 8*). Furthermore, users can edit and make changes to the posts they have posted during the current day either by clicking on the post or by using the active exercise menu. After the users have finished the exercise they are asked to

answer again the subjective assessment question and the “Scale of Positive and Negative Experience (SPANE)” questionnaire. While, if a user doesn’t enter three 3 good things or positive events for one day the exercise expires and the user have to repeat the exercise.

The *Share Entries* page uses a horizontal scrolling tab menu to show each day the good things / positive events that users have shared. Each post displays user’s nickname, date and time and the text that the user has written. Share Entries page can be seen in *Figure 9*.



**Figure 10:** Subjective assessment



**Figure 11:** Exercise assessment

Statistics page shows scores coming from subjective assessment questions’ answers and from questionnaires’ answers. Scores are indicated in graphs and explanations about scores are given. In detail, Statistics page uses a scrolling tab menu to show in one layout the score coming from subjective assessment question (see *Figure 10*) giving to users information about their estimation about positive events/good things, while in the other layout they can see the assessment of psychological flourishing and feelings estimating

from “Scale of Positive and Negative Experience (SPANE)” questionnaire (see *Figure 11*).

#### **4.4.2 Savoring Exercise**

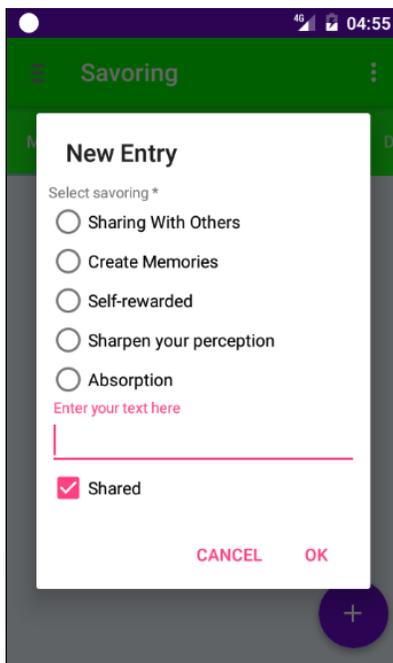
The objective of *Savoring exercise* is to help users to acquire savoring skills and to promote their use in their daily life (Parks & Seligman, 2007; Hurley & Kwon, 2012). As mentioned previously (see section 3.2.1.5), by doing this exercise users realize whether they enjoy the everyday pleasures of their life and learn how to savor the moment, to enjoy and focus on positive events at the present and to identify the positive events in their everyday life too (Manual et al., 2007; Villani et al., 2016).

The Home page of the exercise describes the purpose, the duration and the terms of the exercise. A brief description of the purpose informs the users about the aim of the exercise. Additionally, this page informs users that the duration of the exercise is seven (7) days and that they have to enter at least two (2) experiences per day within forty eight (48) hours describing the experiences they savoured that day. The exercise’s Home Page layout is like the layout is showed in *Figure 6*.

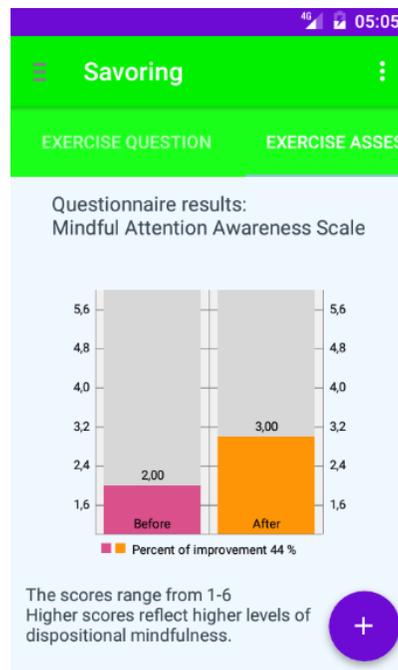
Instruction page gives to users’ detailed information about what they have to do. In detail, it asks to users to think of a typical day and to consider how much time they spend focusing on and savouring the pleasures of the day, either small or large. Also it asks them every day for the next week, to savour at least two experiences. It advises them at the end of each day to write down these experiences and the way with which they enjoyed them. Furthermore, it gives clarifications to users, proposing ways to savour such as to share their experience with others, to take photos or a souvenir of the event/place that the they enjoyed and recall this later with others, to reward themselves for something that went well (e.g. a small successes), to focus on positive things around them and block out the negative ones and to be absorbed by an experience and try not to think, just feel. Instructions’ page layout is presented in *Figure 7*.

When users start the exercise they are asked to complete the exercise questionnaire, called “Mindful Attention Awareness Scale” (layouts like *Figure 19*, *Figure 20*, *Figure 22*). Then they are asked to answer a subjective assessment question. In detail they are asked to think of how often they enjoy everyday pleasures and then on a scale from 0 to 10 to rate the frequency of savoring these pleasures. "0" stands for "never/rarely", "5" stands for "sometimes"

and "10" stands for "always/very often" (layout like *Figure 21*). Then the users have to complete at least two (2) experiences per day. Users can share their posts with others if they like (see *Figure 12*). Each day users can see the posts they have entered, including information such as if the posts are shared or not and the date and time each post is entered (layout like *Figure 8*). Furthermore, users can edit and make changes to the posts they have posted during the current day either by clicking on the post or by using the active exercise menu. After, the users have finished the exercise they are asked to answer again the subjective assessment question and the “Mindful Attention Awareness Scale” questionnaire. While, if a user doesn’t enter at least two posts for one day the exercise expires and the user have to repeat the exercise.



**Figure 12:** New entry - Savoring exercise



**Figure 13:** Exercise assessment

Share Entries page uses a horizontal scrolling tab menu to show each day the posts that users have shared. Each post displays user’s nickname, date and time and the text about savouring that the user has written (layout like *Figure 9*).

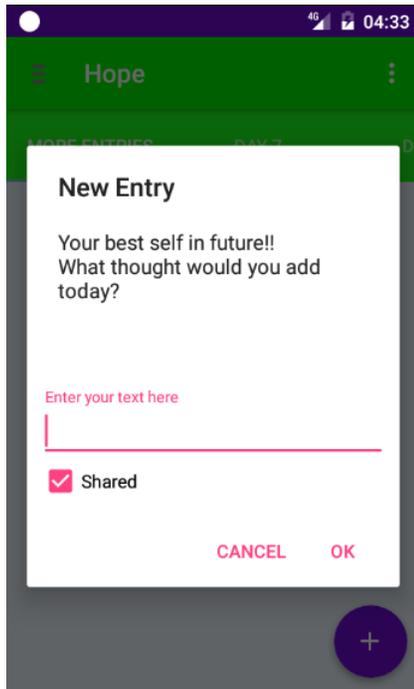
Statistics page shows scores coming from subjective assessment questions’ answers and from questionnaires’ answers. Scores indicating in graphs and explanations about scores are given. In detail, Statistics page uses a scrolling tab menu to show in one layout the score coming from subjective assessment question (layout like *Figure 10*) giving to users information about their estimation about how often they savor everyday pleasures, while in the other layout they

can see the assessment of mindfulness, estimating from “Mindful Attention Awareness Scale” questionnaire (Van Dam, Earleywine, & Borders, 2010) (see *Figure 13* ).

#### 4.4.3 Hope Exercise

The objective of *Hope exercise* is to help users think positive and practice hopeful thinking in the future. This exercise has been shown to help individuals to boost their wellbeing and achieve their goals. By practicing this exercise users acquire the ability to envision methods for achieving their goals and the way to utilize these methods to achieve their goals (Stalikas, 2011; Salmon et al., 2011; Peters, Flink, Boersma, & Linton, 2010).

The Home page of the exercise describes the purpose, the duration and the terms of the exercise (layout like *Figure 6*). A brief description of the purpose informs the users about the aim of the exercise. Additionally, this page informs users that the duration of the exercise is seven (7) days. In the first day and within forty eight (48) hours they have to enter one entry describing their best possible self in the future. Additionally, it suggests them the next days to add new thoughts and ideas about their best self.



**Figure 14:** *New Entry – Hope Exercise*

Instruction page gives to users’ detailed information about what they have to do (layout like *Figure 7*). In detail, it introduces to users during the first day for a few minute to imagine their life in the future. Additionally, it advises them to assume that everything has gone as they liked. They should suppose that, they have worked hard and have succeeded at accomplishing all of their life goals. Then, it asks them to write down about how they imagined their best possible self in the future. Likewise, it proposes them the next days to add new entries adding new features to their best possible self in the future.

When users start the exercise they are asked to complete the exercise questionnaire, called “Hope Scale” (layouts like *Figure 19*, *Figure 20*, *Figure 22*). Then they are asked to answer a subjective assessment question. In detail they are asked to think of how often they have felt hope in the last month and then on a scale from 0 to 10 to rate the frequency of hopeful

thinking. "0" stands for "never/rarely", "5" stands for "sometimes" and "10" stands for "always/very often" (layout like *Figure 21*). Then the users have to complete the first day entry answering the question “Your best self in future!! How do you imagine it?”, while for the following days sentries are optional. From days two to seven users are proposed to add feature about their best possible self in the future by answering the question “Your best self in future!! What thought would you add today?” (see *Figure 14*). Users can share their posts with others if they like. Each day users can see the posts they have entered, including information such as if the posts are shared or not and the date and time each post has been entered, (layout like *Figure 8*). Furthermore, users can edit and make changes to the posts they have posted during the current day either by clicking on the post or by using the active exercise menu. After the users have finished the exercise they are asked to answer again the subjective assessment question and the “Hope Scale” questionnaire. While, if a user doesn’t enter at least one post in the first day the exercise expires and the user have to repeat the exercise.

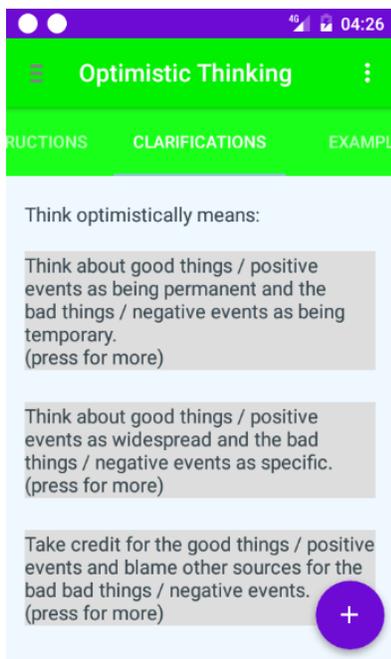
Shared entries page uses a horizontal scrolling tab menu to show each day the posts that users have shared. Each post displays user’s nickname, date and time and the text containing information about writers’ best possible self in the future (layout like *Figure 9*).

Statistics page shows scores coming from subjective assessment questions’ answers and from questionnaires’ answers. Scores are indicated in graphs and explanations about scores are given. In detail, Statistics page uses a scrolling tab menu to show in one layout the score of the subjective assessment question, giving to the users information about their estimation about how often they think hopefully (layout like *Figure 10* ), while in the other layout they can see the estimation of their hope level according to “Hope Scale” questionnaire (Snyder et al., 1996) (layout like *Figure 13* ).

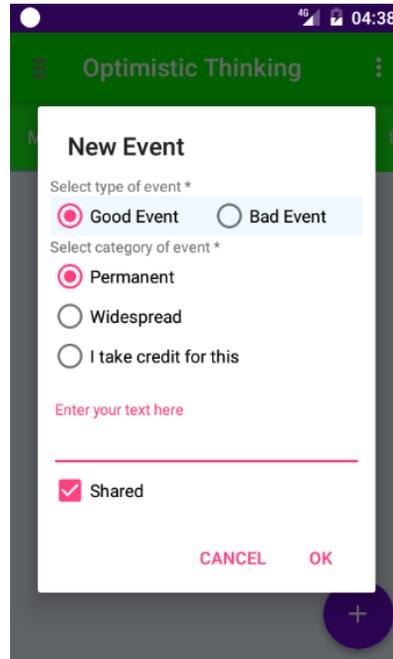
#### ***4.4.4 Optimistic Thinking Exercise***

The objective of the *Optimistic Thinking* exercise is to help users to develop optimistic thinking. This exercise has been shown that helps individuals to cultivate an optimistic explanatory style and increase optimistic thinking (Manual et al., 2007; Lyubomirsky & Layous, 2013). By practicing this exercise users learn to experience both the bad/negative events and the good/positive ones more optimistically.

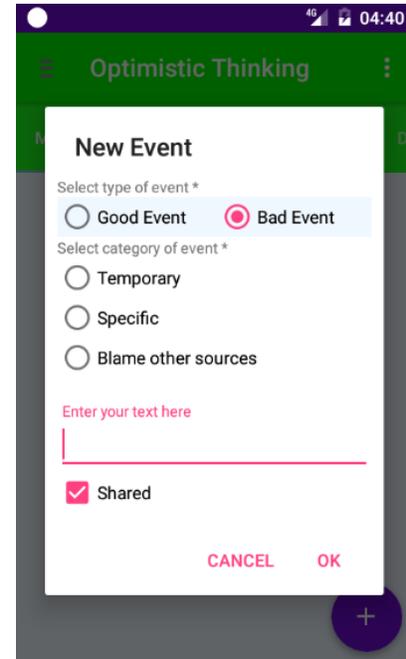
The Home page of the exercise describes the purpose, the duration and the terms of the exercise (layout like *Figure 6*). A brief description of the purpose informs the users about the aim of the exercise, pointed out that even people who are very optimistic can learn to think more optimistically. Additionally, this page informs users that the duration of the exercise is seven (7) days. Each day, within forty eight (48) hours they have to enter at least one entry describing an event that had happened to them during that day and whether it was a good (positive) or bad (negative).



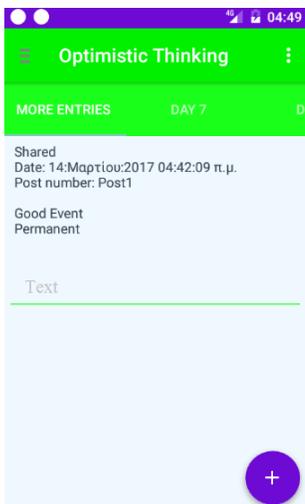
**Figure 16:** Information Pages – Optimistic Thinking Exercise



**Figure 17:** New Entry – Good Event.



**Figure 18:** New Entry – Bad Event.



**Figure 15:** User Entries – More Entries

Instruction page gives to users' detailed information about what they have to do. Additionally, it gives them clarifications about the meaning of term optimism, educating them how to think optimistically of good and bad events and gives them examples. In detail, instruction page uses a horizontal scrolling tab menu to show three different layouts information about a) instructions, b) clarifications, and c) examples (see *Figure 16*). Instruction layout asks the users to think of one event that

had happened to them every day and whether it is a good (positive) or bad (negative). Then they have to write one optimistic thought next to the event. If it is a good (positive) event/situation they should write an optimistic thought and tell if it is permanent, widespread, or for which they take the credit. If it is a bad (negative) event/situation, they should write an optimistic thought and tell if it is temporary, specific, or other sources are to be blamed for. In the clarifications layout detailed explanations are given showing the way that they should think of good (positive) and bad (negative) events/situations optimistically. Finally, the examples layout presents some examples for better understanding.

When users starts the exercise they are asked to complete the exercise questionnaire, called “Revised Life Orientation Test (LOT-R)” (layouts like *Figure 19*, *Figure 20*, *Figure 22*). Then they are asked to answer a subjective assessment question. In detail they are asked to think of how often they have been optimistic in the last month and then on a scale from 0 to 10 to rate the frequency. "0" stands for "never/rarely", "5" stands for "sometimes" and "10" stands for "always/very often" (layout like *Figure 21*). Then the users have for each day to complete at least one event that happened to them during the day and whether it was a good (positive) or bad (negative) and to complete one optimistic thought about the event. Furthermore, they have to characterize good events as permanent, widespread, or for which they take the credit (see *Figure 17*), and bad events as temporary, specific, or to blame other sources for (see *Figure 18*). Users can share their posts with others if they like. In each day users can see the posts they have entered, including information such as if the posts are shared or not and the date and time each post entered (see *Figure 15**Figure 18*). Furthermore, users can edit and make changes to the posts they have posted during the current day either by clicking on the post or by using the active exercise menu. After the users have finished the exercise they are asked to answer again the subjective assessment question and the “Revised Life Orientation Test (LOT-R)” questionnaire. While, if a user doesn’t enter at least one post in one day the exercise expires and the user have to repeat the exercise.

Share Entries page uses a horizontal scrolling tab menu to show each day the posts that users have shared. Each post displays user’s nickname, date and time and the text containing information about writers’ events (layout like *Figure 9*).

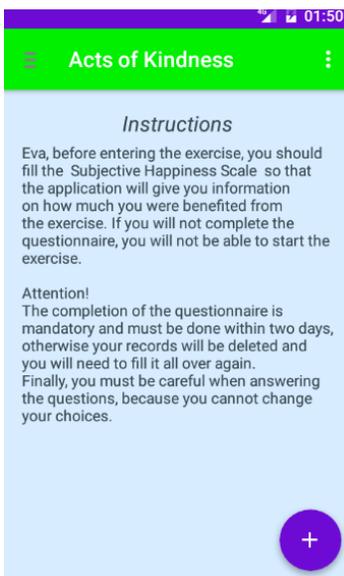
Statistics page shows scores coming from subjective assessment questions’ answers and from questionnaires’ answers. Scores are indicated in graphs and explanations about scores are

given. In detail, Statistics page uses a scrolling tab menu to show in one layout the score coming from subjective assessment question giving the users information about their estimation about how often they have been optimistic during the last month (layout like *Figure 10*), while in the other layout they can see the estimation of optimism level according to “Revised Life Orientation Test (LOT-R)” questionnaire (Glaesmer et al., 2012) (layout like *Figure 13*).

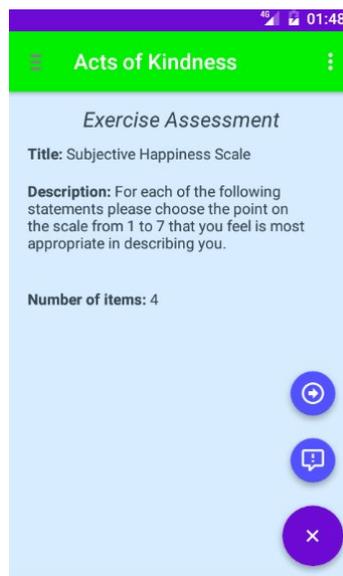
#### 4.4.5 Acts of Kindness Exercise

The objective of the *Acts of Kindness* exercise is to activate people to do acts of kindness in their everyday life. Its aim is to educate users to consciously perform acts of kindness in their daily life in order to increase their happiness. The performance of this exercise enhances users’ level of happiness and well-being (Villani et al., 2016) because they feel good about themselves. By cultivating kindness, people are motivated to be kind to others and to recognize kindness coming from others (Otake et al., 2006).

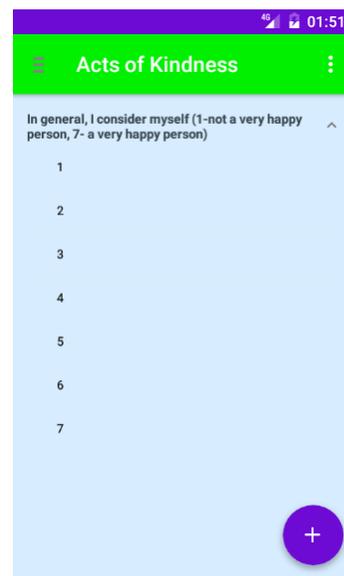
Home page of the exercise describes the purpose, the duration and the terms of the exercise (layout like *Figure 6*). A brief description of the purpose shows to users the aim of the exercise. Additionally, this page informs users that the duration of the exercise is seven (7) days and that they have to enter three(3) inputs within forty eight (48) hours describing the acts of kindness they have done in that day.



**Figure 19:** Exercise assessment questionnaire main page



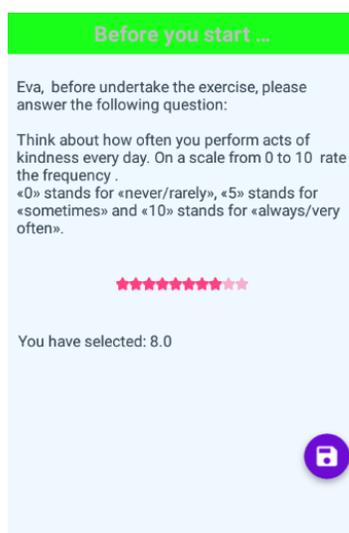
**Figure 20:** Exercise assessment questionnaire instructions page



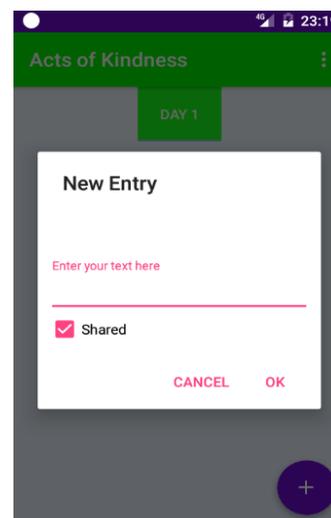
**Figure 21:** Exercise assessment questionnaire completion page

Instruction page gives to users' detailed information about acts of kindness (layout like *Figure 7* **Σφάλμα! Το αρχείο προέλευσης της αναφοράς δεν βρέθηκε.**). In detail, it explains that the acts of kindness are behaviors that benefit other people or make others happy and the person that act kindly. Additionally presents examples of acts of kindness in order to give ideas to users. Furthermore, it shows a video that shown how the acts of kindness boomerang back to persons when they do acts of kindness.

When user starts the exercise they are asked to complete the exercise questionnaire, called "Subjective Happiness Scale" (see *Figure 19*, *Figure 20*, *Figure 22*). Then they are asked to answer a subjective assessment question. In detail they are asked to think how often they perform acts of kindness throughout a day and on a scale from 0 to 10 to rate the frequency. "0" stands for "never/rarely", "5" stands for "sometimes" and "10" stands for "always/very often" (see *Figure 21*). Each day the users have to complete three (3) acts of kindness that they did during that day. The users can share their posts with others if they like (see *Figure 23*). Each day the users can see the posts they have entered, including information such as if the posts are shared or not and the date and time each post has been entered (layout like *Figure 8*). Furthermore, users can edit and make changes to the posts they have posted during the current day either by clicking on the post or by using the active exercise menu. After the users have finished the exercise they are asked to answer again the subjective assessment question and the "Subjective Happiness Scale" questionnaire. While, if a user doesn't enter three (3) acts of kindness in a day the exercise expires and the user have to repeat the exercise.



**Figure 22:** User Subjective Assessment



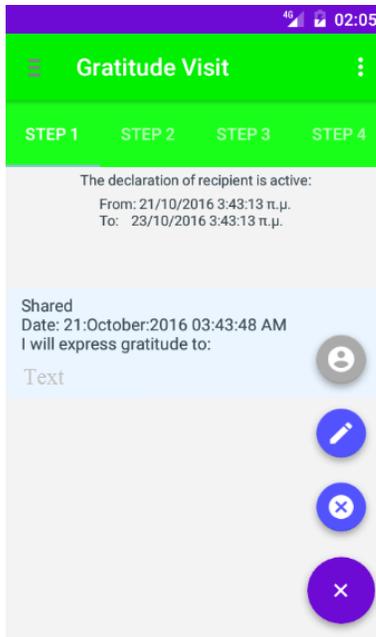
**Figure 23:** New entry – Acts of Kindness Exercise

Share Entries page uses a horizontal scrolling tab menu to show each day the acts of kindness that users have shared. Each post displays user's nickname, date and time and the text that the user has written (layout like *Figure 9*).

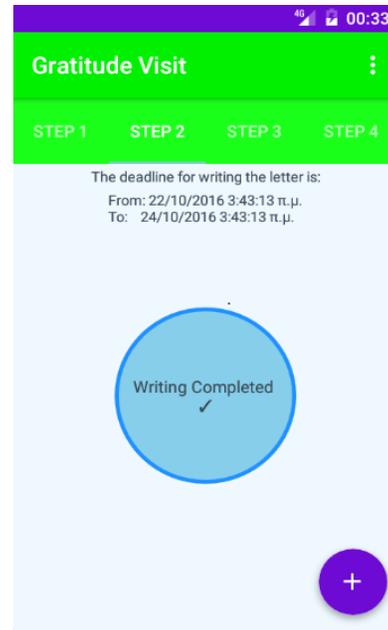
Statistics page shows scores coming from subjective assessment questions' answers and from questionnaires' answers. Scores are indicated in graphs and explanations about scores are given. In detail, Statistics page uses a scrolling tab menu to show in one layout the score of the subjective assessment question giving the users information about their estimation about the frequency they perform acts of kindness (layout like *Figure 10*), while in the other layout they can see the assessment of happiness level estimating from "Subjective Happiness Scale"(Lyubomirsky & Lepper, 1999) questionnaire (layout like *Figure 13*).

#### ***4.4.6 Gratitude Visit Exercise***

The *Gratitude Visit* exercise has many benefits in well-being and consequently in happiness (Manual et al., 2007; Weytens et al., 2014; Parks & Seligman, 2007). Its aim is to activate users to think of persons who have helped them in some way in the past or who have been especially kind to them and they would like to express gratitude towards them. By practising gratitude actions people felt positive feelings, such as kindness, pride, love, enthusiasm, and gratitude (Manual et al., 2007; Weytens et al., 2014; Ouweneel et al., 2014; Parks & Seligman, 2007). Furthermore, they receive kindness by the other persons and this strengthened even more their positive feelings.



**Figure 24:** Step 1- Gratitude Visit Exercise



**Figure 25:** Step 2 - Gratitude Visit Exercise

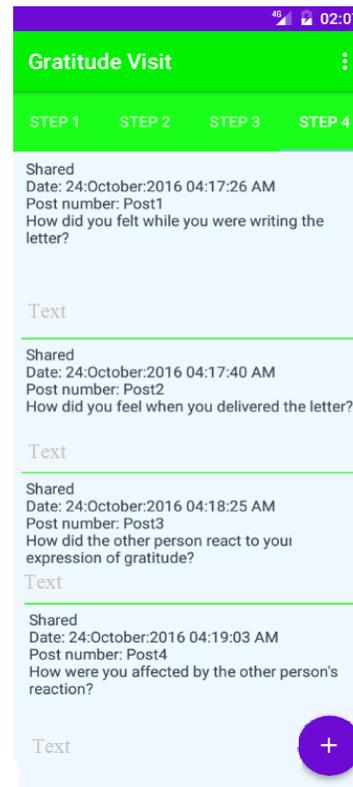
The Home page of the exercise describes the purpose, the duration and the terms of the exercise (layout like *Figure 6*). A brief description of the purpose shows to users the aim of the exercise. Additionally, this page informs users that the duration of the exercise is seven (7) days. It informs them that the exercise includes four (4) steps, in first day and within forty eight (48) hours they should perform step one, in the second day and within forty eight (48) hours they should perform step two, in third day and within forty eight (48) hours they should perform step three, and from days four to seven they have to perform step four.

The instruction page gives to users' detailed information of the exercise flow describing the four steps (layout like *Figure 7*). In detail, it asks them to think of the people (e.g., parents, friends, teachers, employers) who have been especially kind to them but whom they have never properly thanked. Then they are asked to choose someone with whom they would like to arrange a face to face meeting in the next week. Then they are asked to write down a gratitude letter or a note to this person and deliver it in person by reading it aloud or explain the purpose of this exercise and give it to him/her to read it. It suggests them to be specific about what he/she has done for them and how it influenced their life. Furthermore, it asks the users to tell the recipient of the letter/note that they have never forget what he/she has done. After the gratitude visit, it asks to users to think of their experience: how did they feel as they wrote the letter and how did they feel when they delivered it? How did the other person react to their expression of gratitude?

Did his/her reaction influence the users and how? Moreover, it gives them clarifications about what each step includes.



**Figure 26:** Step 3 - Gratitude Visit Exercise



**Figure 27:** Step 4 - Gratitude Visit Exercise

When user starts the exercise they are asked to complete the exercise questionnaire, called “Gratitude Questionnaire” (Chen, Chen, Kee, & Tsai, 2009) (layouts like *Figure 19*, *Figure 20*, *Figure 22*). Then the users have to perform steps as describes follow: a) Step 1 – Day 1: Within forty eight (48) hours they have to choose a person who has done something good for them and for which they never had the chance to thank him/her for (see *Figure 24*). b) Step 2 – Day 2: Within forty eight (48) hours they have to write a letter to that person describing what he/she has done, what it meant to them, and how grateful they are (see *Figure 25*). c) Step 3 – Day 3: Within forty eight (48) hours they have to arrange a meeting with that person, to deliver the letter and to read it aloud to him/her (see *Figure 26*). d) Step 7 – Days 4 -7: they have to answer the following four questions, “How did you feel as you wrote the letter”, “How did you feel when you delivered the letter?”, “How did the other person react to your expression of gratitude?” and “ Did his/her reaction influence you and how?”. The users scan share their entries in step 1 and step 4 with others if they like. During the execution of the exercise, users can see and make changes to their entries in the current step (see *Figure 27*). After the users have

finished the exercise they are asked to answer again the “Gratitude Questionnaire” questionnaire. While, if a user doesn’t complete one of the steps on time the exercise expires and the user have to repeat the exercise.

Share Entries page uses a horizontal scrolling tab menu to show shared entries in steps one and four. Each post displays user’s nickname, date and time and the text that the user has written (layout like *Figure 9*). Statistics page shows scores coming from “Gratitude Questionnaire» questionnaire’s answers. Scores are indicated in graphs and explanation about scores is given (layout like *Figure 13* ).

## 4.5 Well-being Assessment

The first time the users login in the application and after the group selection the application asks them to complete the *Well-being Assessment* questionnaire. After the completion of this questionnaire users are entered automatically in the application. This is the baseline measurement for the assessment of their well-being level. After they have completed the exercises / activities they are asked to complete it again. Additionally, they can continue to complete it (measurements 2-12) once a month, for twelve (12) months, in order to measure their happiness level.

The *Well-being Assessment* questionnaire consists of following four questionnaires: a) Psychological Well-Being, b): a) Psychological Well-Being, b) Life Satisfaction Scale, c) Brief Symptom Inventory-18, and d) Flourishing Scale. The layout of the “Well-being Assessment Questionnaire” is showed in *Figure 28*. Users by tapping the 1<sup>st</sup> button are entered in the *Psychological Well-Being* questionnaire (layouts like *Figure 19*, *Figure 20*, *Figure 22*). Likewise, by tapping the 2<sup>nd</sup> button users are entered in the *Life Satisfaction Scale* questionnaire, the 3<sup>rd</sup> in the *Brief Symptom Inventory-18* and the 4<sup>th</sup> in the *Flourishing Scale* questionnaire.

The Psychological Well-Being results are presented in *Figure 29*. By tapping the Overall Measurement Graph, users can see the scores in numbers (see *Figure 30*). In the same manner, by tapping subscale graph they can see the subscales’ scores estimation in numbers (see *Figure 31*). The results from Life Satisfaction Scale are presented in *Figure 32*, and from Brief Symptom Inventory-18 in *Figure 33*. The results from Flourishing Scale are presented like in *Figure 33*. Also, all scores can be seen in numbers by pressing the graphs.

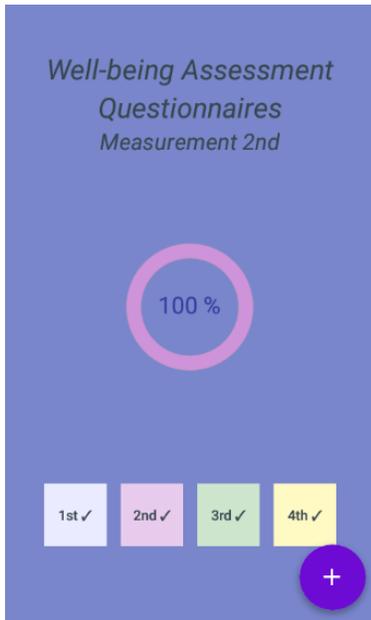


Figure 28: Well-being Assessment

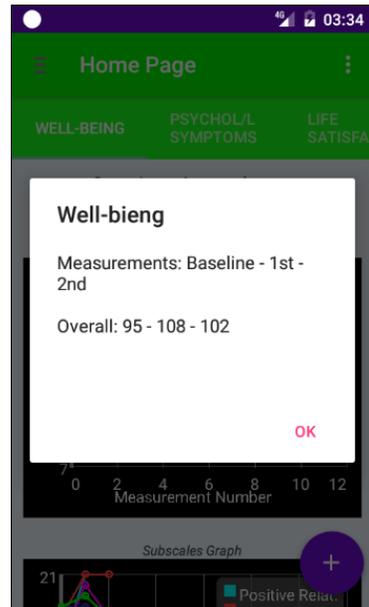


Figure 30: WB Overall scores in numbers

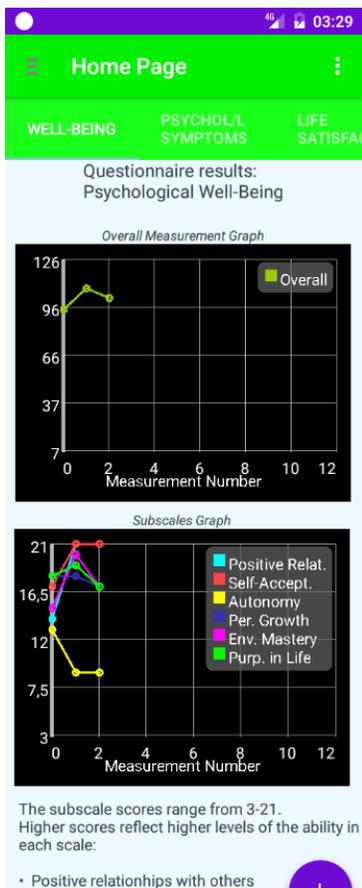


Figure 29: WB-Scores

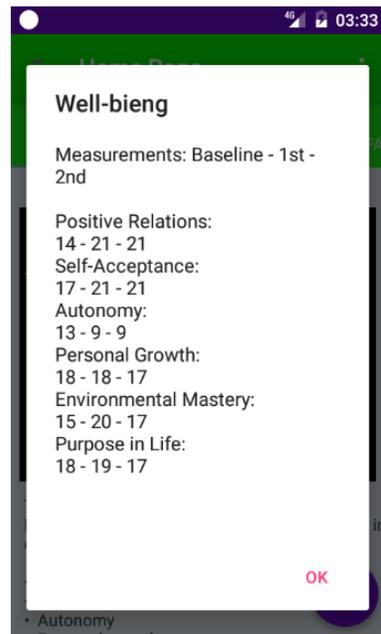
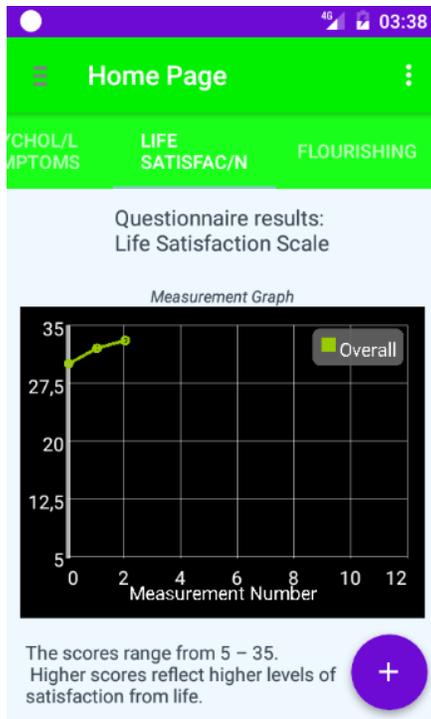
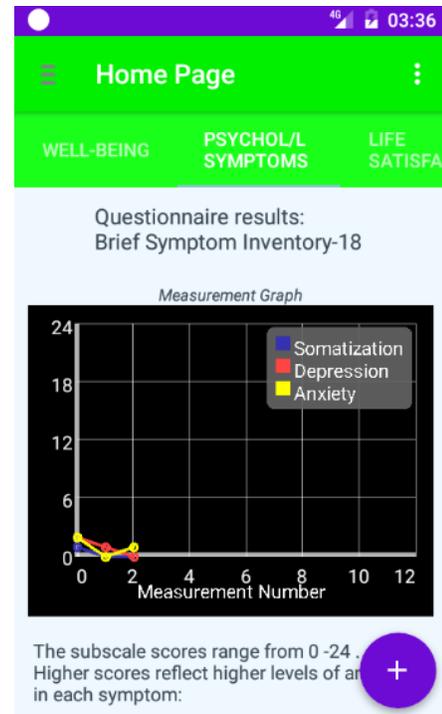


Figure 31: WB Subscale scores in numbers



**Figure 32:** *Life Satisfaction Scale Scores*



**Figure 33:** *Brief Symptom Inventory-18 Scores*

## 4.6 Questionnaires Used

In the following subsections are described in detail the Questionnaire used in the application. Information about type of measurements, questions number and scores are given.

### 4.6.1 Psychological *Well-Being*

Psychological Well-Being questionnaire ([Appendix B.1](#)) is based on a model developed by Ryff and her colleagues (Cheng & Chan, 2005). Ryff and her colleagues have generated a multidimensional model of Well-being which consist of six distinct components of Positive Psychology such as autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance(Cheng & Chan, 2005; C D Ryff & Keyes, 1995; van Dierendonck, 2004; Carol D. Ryff & Singer, 2006). In detail it measures a) the sense of control or self-determination (Autonomy), b) the sense of achievement, the continued growth and the

development as a person (Personal Growth), c) the sense of having good and quality relations with other people(Positive Relations With Others), d) the sense of living a purposeful and meaningful life (Purpose in Life), e) the sense of understanding and accept yourself (Self-Acceptance), f) the sense of having the capacity to manage effectively the surrounding world (Environmental Mastery).

The questionnaire consists of eighteen (18) questions. Users are asked to answer indicating how they agree or disagree using a score rating from 1-(Strongly Disagree) to 7-(Strongly Agree). The subscale scores range from 0-24 while the overall score range from 7-126. Higher scores reflect higher levels of psychological well-being. The Psychological Well-Being questionnaire is included in main questionnaire of the application. *Figure 29* shows how scores as presented in the application.

#### **4.6.2 Life Satisfaction Scale**

The Life Satisfaction Scale questionnaire ([Appendix B.2](#)) is used to estimate the total sense of satisfaction a person has about his/her life. Pavot, Diener, Colvin and Sandvik (1991), as referred by (Seligson, Huebner, Valois, & Huebner, 2014), defined life satisfaction as the global evaluation of a person about the quality of his/her life. The Life Satisfaction Scale measures emotional well-being with discriminant validity. It measure the evaluation a person does about his/her life judging using his/her own criteria (Pavot & Diener, 2008).

The questionnaire consists of eighteen (5) questions. Users are asked to answer indicating how they agree or disagree using a score rating from 1-(Strongly Disagree) to 7-(Strongly Agree. The subscale scores range from 5-35. Higher scores reflect higher levels of satisfaction from life. The Life Satisfaction Scale questionnaire is included in main questionnaire of the application. *Figure 32* shows how scores as presented in the application.

#### **4.6.3 Brief Symptom Inventory-18**

The Brief Symptom Inventory -18 (BSI – 18) questionnaire ([Appendix B.3](#)) is an abbreviated version of the Brief Symptom Inventory which, in turn, is an abbreviate version of the Symptom Checklist – 90 (Asner-Self, Schreiber, & Marotta, 2006; Franke et al., 2017; Galdón et al., 2008). Symptom Checklist – 90 consists of 90 questions and measures nine independent symptoms dimensions of psychological distress. The BSI consists of 50 questions and measures nine dimensions of psychological distress too. The BSI -18 consists of eighteen

(18) questions and measures three dimensions of psychological distress. It is a reliable and useful tool and measures the most common psychiatric disorders which are depression (DEP), anxiety (ANX) and somatization (SOM) (Franke et al., 2017; Galdón et al., 2008). The BSI – 18 questions divided equally among (DEP), (ANX) and (SOM).

The BSI – 18 questionnaire is included in main questionnaire of the application. Users are asked to answer how much they were annoyed by the list of statements of problems during the last week. They have to choose between 0-Not at all to 4-Very much. The subscale scores range from 0-24. Higher scores reflect higher levels of annoyance in each symptom: (DEP), (ANX) and (SOM). *Figure 33* shows how scores are presented in the application.

#### ***4.6.4 Flourishing Scale***

The Flourishing Scale (FS) ([Appendix B.4](#)) has been developed by Diener et al. (2009, 2010), as referred by (Sumi, 2013). It consists of 8-item questions and designed to measure human flourishing level and Subjective Well Being. The Flourishing Scale encompasses items regarding important aspects of social and psychological human functioning such as relationships, self-esteem, self-acceptance, optimism, purpose, feeling of competence, meaning and engagement (Diener et al., 2010; Silva & Caetano, 2013; Sumi, 2013; Hone, Jarden, & Schofield, 2013). In other words it estimates the positive functioning of a person which has significant impact on SWB (Silva & Caetano, 2013). FS items are included espoused recent theories of well-being and used in well-being studies.

The FS questionnaire is included in main questionnaire of the application. Users are asked to answer how much they agree with each statement by placing the appropriate number. They have to choose between 1-Strongly disagree to 7-Strongly agree. The scale provides a single score which ranges from 8-56. Higher scores reflect higher levels of psychological well-being. *Figure 33* shows how scores as presented in the application.

#### ***4.6.5 Scale of Positive and Negative Experience (SPANE)***

The Scale of Positive and Negative Experience (SPANE) ([Appendix B.5](#)) has been created by Diener et al. (2010), as referred by (Silva & Caetano, 2013; Sumi, 2013). The SPANE questionnaire consists of twelve (12) questions that measure the positive and the negative feeling. In detail, six questions assess positive feelings and six assess the negative ones (Silva & Caetano, 2013; Sumi, 2013). Likewise, it has been designed in such a way that three of

the six scale questions are general (e.g. positive, negative) and the three other questions are more specific (e.g. joyful, sad) (Diener et al., 2010). The SPANE not only captures the desirable and undesirable feelings but reflects experiences such as interests, engagement, flow, physical pleasure and pain. The SPANE captures feelings stem from many theories.

The SPANE questionnaire is given to both modes (Group 1, Group 2) of the application in the first week. Users are asked to think about what they have been doing and experiencing during the past four weeks. Then they are asked to report how much they experienced each of the questionnaire feelings. They have to choose between 1- (Very Rarely or Never) to 5 – (Very Often or Always). The score about positive feelings can vary from 6 to 30. Higher scores reflect higher positive feelings. The score about negative feelings can vary from 6 to 30. Higher scores reflect higher negative feelings. The affect balance score can vary from -24 (unhappiest possible) to 24 (highest affect balance possible). A respondent with a very high score of 24 reports that she or he rarely or never experiences any of the negative feelings and very often or always has all of the positive feelings.

#### ***4.6.6 Mindful Attention Awareness Scale***

The Mindful Attention Awareness Scale (MAAS) ([Appendix B.6](#)) was developed by Brown and Ryan (2003), as referred by (Chadwick et al., 2008). It is an easy and brief scale consisting of fifteen (15) questions. The MAAS measures the tendency and the attention / awareness of peoples' daily life (Soler et al., 2012; Van Dam et al., 2010; Cebolla, Luciano, DeMarzo, Navarro-Gil, & Campayo, 2013; Hansen, Lundh, Homman, & Wångby-Lundh, 2009). Actually, it contains questions that focus on the reverse of mindfulness such as the lack of attention and the lack of awareness of what is occurring in the present. It is a reliable and valid measure tool designed to measure mindfulness for the adult population (Hansen et al., 2009). The MAAS has been mainly used to evaluate mindfulness for those how suffering from disorders such as depression, stress, bulimia, chronic pain and cancer (Soler et al., 2012).

The MAAS questionnaire is given to both modes (Group 1, Group 2) of the application in the second week. Users asked to answer the questions according to what really reflects to their experience rather than what they think their experience should be. They have to choose between 1- Almost Always to 6 -Almost Never. The scale provides a single score which ranges from 1-6. Higher scores reflect higher levels of dispositional mindfulness.

#### **4.6.7 Hope Scale**

The Hope Scale ([Appendix B.7](#)) was developed by Snyder and colleagues (1991), as referred by (Snyder et al., 1996). It is validated as a dispositional self-report measure of hope and optimism (Snyder et al., 1996). It offers a brief questionnaire designed for fifteen (15) years old people and older, which defines hope as "a positive motivational state that is based on an interactively derived sense of successful (a) agency (goal-directed energy), and (b) pathways (planning to meet goals)" (Marques, Pais-Ribeiro, & Lopez, 2009). It consists of twelve (12) questions.

The Hope Scale questionnaire is given to both modes (Group 1, Group 2) of the application in the third week. Users are asked to answer the questions according to the answer that best describes them. They have to choose between 1- Definitely False to 8 - Definitely True. The scale provides a single score which ranges from 0-24. Higher scores reflect higher levels of hope and optimism.

#### **4.6.8 Revised Life Orientation Test (LOT-R)**

The Revised Life Orientation Test (LOT-R) ([Appendix B.8](#)) is a revised version of Life Orientation Test (LOT) and it has been designed to measure self-reported dispositional optimism (Glaesmer et al., 2012; Bastianello, Pacico, & Hutz, 2014). The LOT-R includes questions measuring the optimism (i.e. the belief that good things will happen) and the pessimism (i.e. the belief that bad things will happen) (Segerstrom, Evans, & Eisenlohr-Moul, 2011). In this way it measures the total dispositional optimism. It is one of the most frequently used questionnaires for dispositional optimism measurements. Several studies have documented the reliability and the validity of the scale (Chiesi, Galli, Primi, Innocenti Borgi, & Bonacchi, 2013).

The Revised Life Orientation Test (LOT-R) is given to both modes (Group 1, Group 2) of the application in the fourth week. Users are asked to answer the questions according to their feelings, rather than how they think "most people" would answer. They have to choose between 0 - Strongly disagree to 4 - Strongly agree. The scale provides a single score which ranges from 0-24. Higher scores reflect higher levels of optimism.

#### ***4.6.9 Subjective Happiness Scale***

The Subjective Happiness Scale (SHS) ([Appendix B.9](#)) is the most widely used questionnaire for subjective happiness measurements (Mattei & Schaefer, 2004; Swami, 2008). Although it is brief, it contains only four (4) questions, Lyubomersky and Lepper, as referred by (Swami, 2008), claimed that it meets the minimum psychometric criteria for assessing with accuracy person's happiness level. The SHS measures the happiness level in a comprehensive and overall sense (Extremera & Fernández-Berrocal, 2013). Additionally, Lyubomersky and Lepper, as referred by (Moghnie & Kazarian, 2012), showed that SHS has moderate correlation with personality measurements (e.g. extraversion self-esteem) and low correlations with unrelated happiness measures (e.g. academic success and stressful situations).

The Subjective Happiness Scale (SHS) is given to both modes (Group 1, Group 2) of the application in the fifth week. Users are asked to answer the questions according to the answer they think best describe them. The scale provides a single score which ranges from 0-24. Higher scores reflect higher levels of subjective well-being.

#### ***4.6.10 Gratitude Questionnaire***

The Gratitude Questionnaire (GQ) ([Appendix B.10](#)) is a brief, six-item tool that it is used to measure the disposition gratitude that people feel coming from the reaction with others or from the events of the past (Sun & Kong, 2013; Sansone & Sansone, 2010). It is the abbreviation of a thirty nine questionnaire that reflects the gratefulness, appreciations feeling and feelings receiving from others (Toussaint & Friedman, 2009) . Additionally it reflects feeling related to optimism, hope, forgiveness, life satisfaction, and empathy and it is reliable (Sansone & Sansone, 2010).

The GQ is given to both modes (Group 1, Group 2) of the application in the sixth week. Users are asked to answer a seven point Likert Scale questions from 1 - strongly disagree to 7 - strongly agree, selecting the number that indicate how much they agree with each statement. The scale provides a single score which ranges from 0-24. Higher scores reflect higher levels of subjective gratitude.

## 5 Usability and Technical Evaluation

The main aim of this section is to present the usability and technical evaluation of the native android application called “HeHappier” (Arellano, Bochinski, Elias, Houser, & Head, 2012). The usability and technical evaluation of an application focus on measuring the usability and the quality of the application. It is an essential task because it ensures users that the app is accurate and safe for use. However, measuring the usability of an application is particularly difficult because on one hand usability is not a unidirectional concept and on the other hand users have not the same characteristics and requirements (Lewis, 1995).

### 5.1 Definition of Software Usability

*Software Usability* is the assessment of ease of use of a software application judging from user’s perspective (“Usability,” 2017). Usability is important because puts the user at the center of the process and makes the difference between perform a task and enjoy the process of completing a task (“Usability First,” 2015). In other words, it measures the Quality of Experience (QoE) (ETSI TR 102 643, 2010; Brunnström et al., 2013) of the user, estimating the overall acceptability influenced by user expectations and context.

The following three aspects of usability are taking in consideration for all types of software (Nayebi, Desharnais, & Abran, 2012):

- *The efficient of use:* The time to complete a particular task.
- *The Easy of learn:* Operations should be learned by observing the project.
- *User Satisfaction:* If the application meets the user’s expectations.

### 5.2 Mobile Usability Definition

The usability of mobile applications differs from computer applications because of the different characteristics of mobile devices. Mobile devices have physical restrictions such as screen size and wireless connection and battery limitations. So, mobile applications should be designed taking in account these restrictions. For this purpose, Google has published instructions for Android developers as far as concern applications’ user interface (Nayebi et al., 2012). According to these guidelines developers should take in account characteristics such as screen size, touch gestures, location of icons and buttons, contextual menus, text size, and messaging.

There are native and non-native mobile apps (Arellano et al., 2012). Native mobile apps are apps that are coded in a specific programming language like Java for Android or Objective C for iOS. Native apps are installed directly into mobile device, while non-native apps use browsers to run in users' mobile devices. This section focuses in native mobile apps.

*ISO 9241* defines guidelines on usability mentioned that the context of use should include the following aspects (Moumane, Idri, & Abran, 2016; Nayebi et al., 2012; ETSI TR 102 643, 2010):

- *Effectiveness*: How easy is for the uses to complete tasks with accuracy and achieve specific goals without making errors.
- *Efficiency*: Time that spent by users to complete a specific task.
- *User Satisfaction*: The subjective satisfaction of the user, as far as concern the process or the outcome.

Additionally, *ISO 25010* inserts the notions of flexibility in use and safety in use and define satisfaction in use as (Nayebi et al., 2012):

- *Likeability*: The satisfaction of pragmatic goals;
- *Pleasure*: The satisfaction of hedonic goals;
- *Comfort*: The state of physical ease;
- *Trust*: The satisfaction with security.

### **5.3 Usability Evaluation of Mobile Apps**

A well designed mobile app should be based both on usability principles and on mobile design tenets (Arellano et al., 2012). In order to measure the usability of a mobile app it is important to determine the usability factors that need to be measured and the proper usability evaluation method for the evaluation (Hussain et al., 2015).

Usability factors that need to be taken in account determine the research questions. These factors can be the following (Hussain et al., 2015; Lewis, 1995; Stoyanov et al., 2015):

- *Learnability*: How easy the application users can accomplish a task and how quick they perform similar tasks.
- *Efficiency*: It concerns the time that is spent by users to accomplish a task.
- *Memorability*: How easy users can recall how to perform a task.

- *Errors*: The number of mistakes that make a user while he/she tries to complete a task.
- *User Satisfaction*: The subjective satisfaction of the user as far as concern the use of the application.
- *Simplicity*: The comfort with which users find how to complete tasks.
- *Comprehensibility*: How easy users can understand the content of the application.

## **5.4 Usability Evaluation of “BeHappier” App**

After the completion of the application development, the application was given to smartphone users for test and usability evaluation. Fifty five users (55) have signed up; most of them were either employees or students of the Technological University of Crete. For two months they were using the application. During this period they referred the errors they have and new versions of the application were developed. Then the usability evaluation of the application was conducted as described in the following sections.

### ***5.4.1 Usability Evaluation Method***

After users have used the application for two months they were asked to complete two questionnaires for the evaluation of the application. This type of evaluation was chosen because application is structure in such a way that users need at least six weeks to run/see all the application. The questionnaires were the System Usability Scale (SUS) (see *Table 1*) and an Additional Usability Post Test Questionnaire (see *Table 2*).

SUS System Usability Scale (SUS) is a quick and easy questionnaire which used in many usability studies and gives a global view of subjective assessment of usability (Brooke, 1996; Sauro, 2011) . It is a ten-item Likert Scale Questionnaire. Beside to each question the degree of agreement or disagreement with the statement on 1 to 5 point scale is indicated. Despite SUS is a wide used questionnaire there has been little guidance about its scores. Sauro (2011), as referred by (Sauro, 2011), referred that the average score from 500 studies is 68. So, scores below 68 is below average.

Additional Usability Post Test Questionnaire is a ten-item Likert Scale Questionnaire. Beside to each question the degree of agreement or disagreement with the statement on 1 to 5 point scale is indicated (see *Table 2*).

**Table 1:** System Usability Scale (SUS)

		<b>Strongly disagree</b>			<b>Strongly agree</b>	
		1	2	3	4	5
1	I think that I would like to use the Application frequently.	<input type="checkbox"/>				
2	I found the Application to be simple.	<input type="checkbox"/>				
3	I thought the Application was easy to use.	<input type="checkbox"/>				
4	I think that I could use the Application without the support of a technical person.	<input type="checkbox"/>				
5	I found the various functions in the Application were well integrated.	<input type="checkbox"/>				
6	I thought there was a lot of consistency in the Application.	<input type="checkbox"/>				
7	I would imagine that most people would learn to use the Application very quickly.	<input type="checkbox"/>				
8	I found the Application very intuitive.	<input type="checkbox"/>				
9	I felt very confident using the Application.	<input type="checkbox"/>				
10	I could use the Application without having to learn anything new.	<input type="checkbox"/>				

Table 2: Additional Usability Post Test Questions

		<b>Strongly disagree</b>			<b>Strongly agree</b>	
		1	2	3	4	5
1	The app had a clear, clean, uncluttered screen design.	<input type="checkbox"/>				
2	The app kept screen changes to a minimum during completion of a task in exercises and questionnaires.	<input type="checkbox"/>				
3	The app minimized the number of steps it took to complete a task.	<input type="checkbox"/>				
4	Information presented on screens was easy to comprehend quickly.	<input type="checkbox"/>				
5	Documentation was clear and well integrated for completing tasks.	<input type="checkbox"/>				
6	Choice lists were clear and unambiguous.	<input type="checkbox"/>				
7	There was consistency in workflow among exercises.	<input type="checkbox"/>				
8	Notifications were presented on time and were well informative.	<input type="checkbox"/>				
9	It was clear to me which was the next task.	<input type="checkbox"/>				
10	I felt confident to complete a task without making mistakes.	<input type="checkbox"/>				

This is a supplementary questionnaire for estimating efficiency, effectiveness, user satisfaction and platform optimization (Arellano et al., 2012).

### 5.4.2 Data Analysis

By setting 90% confidence level, 0.2 standard deviation, and a margin of error (confidence interval) of +/- 10%, we estimate that we need a sample size of the order of 43 individuals.

Necessary Sample Size =  $(Z\text{-score})^2 * \text{StdDev} * (1\text{-StdDev}) / (\text{confidence interval})^2$  (Israel, 2013)

90% confidence level => Z Score = 1.645

Necessary Sample Size =  $((1.645)^2 * 0.2(0.8)) / (0.1)^2 = (2.706025 * 0.16) / 0.01 = 0.432964 / 0.01 = 43.29$

As we mentioned in the previous section two (2) questionnaires was made in Google forms. An email was sent to users to inform them that they have to complete both of them. The actual users that were registered to evaluate the App were fifty five (55). Fourteen (14) of them failed to register their evaluation comments. As a result a total number of forty one 41 respondents did actually filled the evaluation questionnaires.

*Table 3* shows the scores of *SUS* questionnaire. In detail, it shows the average mean of each question scores, the total questionnaire score as well as the percent of 100. The calculation of the score is the following (Brooke, 1996; Sauro, 2011):

- First the average mean of each question was sum for the estimation of the total score.  
Sum=4,02+4,12+4,22+4,22+4,22+4,37+4,20+4,44+4,15+4,37 =42,32  
The sum is 42,32 of 50.
- The sum was multiplied by 2 to obtain the overall value from 0 to 100 instead from 0 to 50. Therefore, Sum = 42,32\*2 = 84,63%

A graphical representation of scores is shown in *Figure 34*.

*Table 4* shows the scores of *Additional Usability Post Test Questionnaire*. In detail, it shows the average mean of each question scores, the total questionnaire score as well as the percent of 100. The calculation of the score is the following (Brooke, 1996; Sauro, 2011):

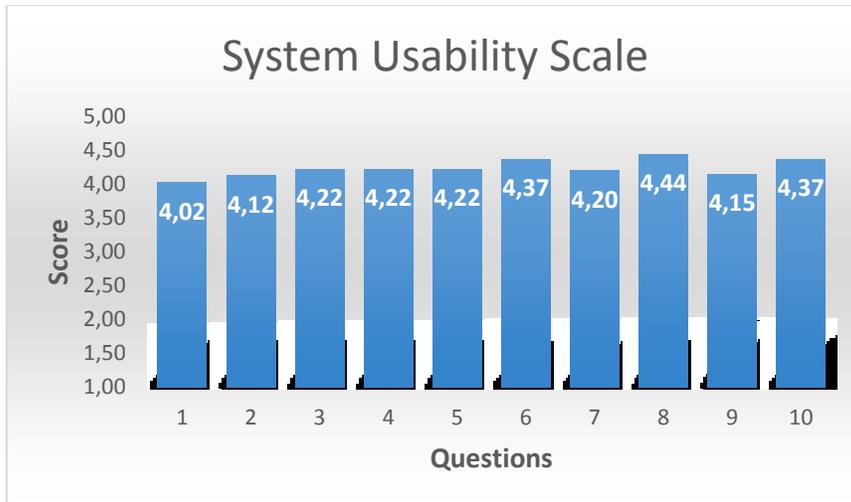
- First the average mean of each question was sum for the estimation of the total score.  
Sum=4,39+4,32+4,24+4,54+4,39+4,54+4,54+4,44+4,34+4,34 =44,07  
The sum is 44,07 of 50.
- The sum was multiplied by 2 to obtain the overall value from 0 to 100 instead from 0 to 50. Therefore, Sum = 44,07\*2 = 88,15%

**Table 3:** SUS scores

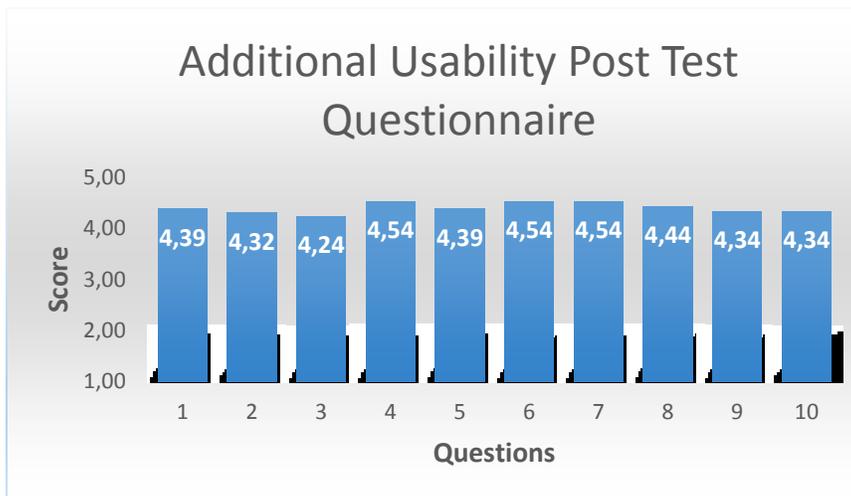
Questions	Score
1. I think that I would like to use the Application frequently.	4,02
2. I found the Application to be simple.	4,12
3. I thought the Application was easy to use.	4,22
4. I think that I could use the Application without the support of a technical person.	4,22
5. I found the various functions in the Application were well integrated.	4,22
6. I thought there was a lot of consistency in the Application.	4,37
7. I would imagine that most people would learn to use the Application very quickly.	4,20
8. I found the Application very intuitive.	4,44
9. I felt very confident using the Application.	4,15
10. I could use the Application without having to learn anything new.	4,37
<b>Sum</b>	<b>42,32</b>
<b>Sum %</b>	<b>84,63</b>

**Table 4:** Additional Usability Post Test Questionnaire scores

Questions	Score
1. The app had a clear, clean, uncluttered screen design.	4,39
2. The app kept screen changes to a minimum during completion of a task in exercises and questionnaires.	4,32
3. The app minimized the number of steps it took to complete a task.	4,24
4. Information presented on screens was easy to comprehend quickly.	4,54
5. Documentation was clear and well integrated for completing tasks.	4,39
6. Choice lists were clear and unambiguous.	4,54
7. There was consistency in workflow among exercises.	4,54
8. Notifications were presented on time and were well informative.	4,44
9. It was clear to me which was the next task.	4,34
10. I felt confident to complete a task without making mistakes.	4,34
<b>Sum</b>	<b>44,07</b>
<b>Sum %</b>	<b>88,15</b>



**Figure 34:** *SUS scores*



**Figure 35:** *Additional Usability Post Test Questionnaire scores*

A graphical representation of scores is showed in *Figure 34* & *Figure 35*. The overall usability of the application estimated by SUS is 84,63 %.

The overall usability of the application estimated by SUS is 84,63 %. While the estimation of *Additional Usability Post Test Questionnaire* yields 88,15 %.

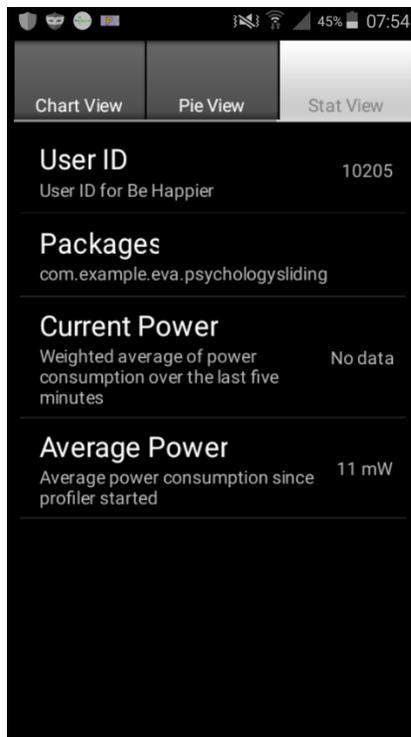
#### **5.4.3 “BeHappeir” App Power Consumption**

Smartphones are mobile electronic devices that are powered from batteries which have limited size. Battery capacity is restricted by size and weight. The longest battery capacity for smartphones is 5000mAH (milli-ampere-hour or amp-hour) (“Candytech,” 2017) . Also,

smartphone consumers prefer to charge their devices as infrequently as they can. Hence, applications' power consumption is critical for the usability of the application. Developers take in consideration this aspect and try to develop energy efficient applications.

It is important to measure how much power each app consumes. Power consumption is measured in watts (W). The average power consumption of Smartphone common tasks are the following (“Mobile Apps and Power Consumption,” 2013):

- A one-minute phone call: 1054mW
- Sending or and receiving email over mobile network: 610mW
- Video playback: 454mW
- Sending and receive email over Wi-Fi: 432mW
- Audio playback: 320mW
- Sending a text message: 302mW



**Figure 36:** Power consumption when the app runs in the background



**Figure 37:** Power consumption when the application is in use.

There are two ways to measure how much power an app consumes for a period of time. The first is to use a special power measurement hardware device, while the second is to use SW

based methods such as mobile apps like “PowerTutor” or “Little Eye” (“Mobile Apps and Power Consumption,” 2013). The “PowerTutor” app is used for estimating the average power consumption of “*Be Happier*” app. The “PowerTutor” is an android application developed by University of Michigan Ph.D. students. It lets users to monitor their phone's power usage and the efficiency of the apps they run in their mobile device (“making-smartphones-powersmarter @ spectrum.ieee.org,” 2010).

The average power consumption when the app runs in the background is 11mW (see *Figure 36*). While the weighted average of power consumption when the application is in use is 54mW per five (5) minutes (see *Figure 37*). The power consumption of the application is very low whereas the average time that a user spend to complete the required tasks is between five to ten minutes per day. So, the application provides good quality of experience to users in terms of energy consumption. Even if users spend lot of time daily using the application their mobile battery will not be drowned.

## 5.5 Discussion

This study describes the development and the evaluation of the “BeHappier” Android application. “BeHappier” includes six Positive Psychology self-helped exercises/activities that focus on helping individuals to enhance their well-being and their happiness level. Additionally, it includes a series of validated questionnaires for the estimation of users’ happiness level.

Technical evaluation of the application was conducted and new versions were developed correcting all referred bugs. The actual users that were registered the App were fifty five contributed in usability and technical evaluation of the “BeHappier” App. Most of them failed to complete the entire set of exercises/activities, while forty one did actually filled the evaluation questionnaires. The usability score estimated by *System Usability Scale* questionnaire is 84,63 %, while the score of *Additional Usability Post Test Questionnaire* is 88,15 %. Scores are consider to be pretty good according to questionnaires used because are over the 68% (Sauro, 2011) and the sample size used (41 users) for the evaluation is close to necessary sample size needed (43 users) for confidence level 90% (Israel, 2013).

Although, this study has several strengths, future studies could give more accurate usability evaluation results using larger number of evaluators as studies about SUS suggests (Sauro, 2011). Additionally, a wider range of users as far as concern the age and the educational

level, could be used for the evaluation of the application. Likewise, further studies could be conducted estimating the effectiveness of the Positive Psychology exercises/activities given in the application to both individuals and groups of participants.

## 6 Conclusions

This thesis describes the android application “*BeHappier*” which is a smartphone application. “BeHappier” is an innovated tool that promises to help individuals to enhance their well-being and become happier. It is based in Positive Psychology, a new branch of psychology, which uses PPIs that focus on affecting the subjective experiences of people and help them to raise positive emotions and strengths and to boost their well-being. It encompasses two modes. The first one encloses six positive psychology exercises/activities which are proposed by Positive Psychology experts claiming that they have great effect in individuals’ psychology as well as validated questioners for the estimation of well-being. While the second one, encloses only questioners.

“BeHappier” is developed following the principles of material design, encompasses innovated components of state of the art technology providing to user a simple, usable and pleasant navigation. It is a usable App giving simple and well integrated instructions and reminders to the users inform them about the next action they have to do. Additionally, it gives them the opportunity to share their experiences with other peers that use the application, anonymously. Also it gives to users’ truck of their well-being level and of the effectiveness each exercise / activity had to them.

It can be used by individuals everywhere and each time they prefer in order to enhance their well-being. Likewise, it can be used by experts who leading groups as a mean for better performance of Positive Psychology exercises and from researchers in order to analyze the collected data and study the effectiveness of these interventions comparing the data collected from two modes.

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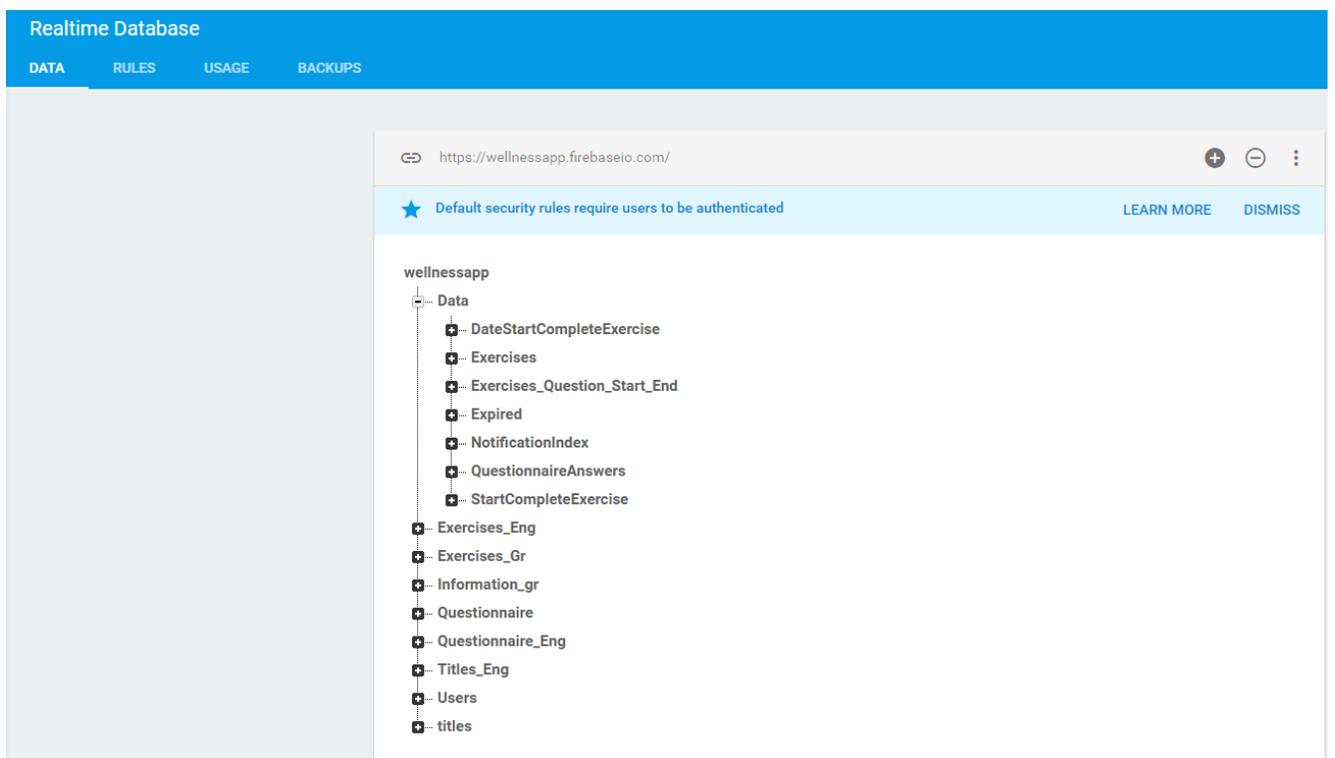
## Appendix A *BeHappier* database in Firebase

This section presents the app's database structure. As we can see the structure of the database is like a tree. The last branch of a tree contains data. The following picture presents an overview of the firebase database console. This console consists of four tabs, Data, Rules, Usage and Backups. Data tab is used for giving access to administrator in application's data. Rules tab is used for setting security rules about database authentication. In our database, as default security rules were set to require authentication for having access to database. Usage Tab presents a graphical representation of database usage. While the Backups is used for backing up the database.

The root of the database named *wellnessapp*. The scheme of the database is the following:

- *Data*: It contains all users' data.
  - *DataStartCompleteExercise* contains users' timetables for the exercises and questionnaire.
  - *Exercises* contains users' data entered from entries they have done from exercises (Day1 to Day 7 and More Entries).
  - *Exercises\_Question\_Start\_End* contains information collected from users' wellbeing subjective assessment before they start and after they finished an exercise.
  - *Expired* contains dates that exercises have expired per user.
  - *NotificationIndex* contains information about the notifications have sent to users.
  - *QuestionnaireAnswers* contains all questionnaires' answers per user.
  - *StartCompleteExercise* contains information about exercise state (active, completed, expired) per user.
- *Exercises\_Eng* contains all information presented in the application as far as concern the exercises in the English language.
- *Exercises\_Gr* contains all information presented in the application as far as concern the exercises in the Greek language.
- *Information\_Gr* contains general information presented in the application in the Greek language.

- *Questionnaire* contains all information presented in the application as far as concern the questionnaires in the Greek language.
- *Questionnaire\_Eng* contains all information presented in the application as far as concern the questionnaires in the English language.
- *Titles\_Eng* contains main navigation drawer menu titles in the English language.
- *Titles* contains main navigation drawer menu titles in the Greek language.
- *Users* contains all users' personal information such as name, email, age, nickname, educational level and marital stage.



**Figure 38:** Database overview

## Appendix B Questionnaires

This section presents the questionnaires used in the application.

### Appendix B.1 Psychological Well-Being

#### Ryff's (1995) Scales of Psychological Well-Being (SPWB)

1	2	3	4	5	6
strongly disagree	moderately disagree	slightly disagree	slightly agree	moderately agree	strongly agree

- 1.\* I tend to be influenced by people with strong opinions.
2. In general, I feel I am in charge of the situation in which I live.
3. I think it is important to have new experiences that challenge how you think about yourself and the world.
- 4.\* Maintaining close relationships has been difficult and frustrating for me.
- 5.\* I live life one day at a time and don't really think about the future.
6. When I look at the story of my life, I am pleased with how things have turned out.
7. I have confidence in my opinions, even if they are contrary to the general consensus.
- 8.\* The demands of everyday life often get me down.
- 9.† For me, life has been a continuous process of learning, changing and growth.
10. People would describe me as a giving person, willing to share my time with others.
- 11.† Some people wander aimlessly through life, but I am not one of them.
12. I like most aspects of my personality.
- 13.† I judge myself by what I think is important, not by the values of what others think is important.
- 14.† I am quite good at managing the many responsibilities of my daily life.
- 15.\* I gave up trying to make a big improvements or changes in my life a long time ago.
- 16.\*† I have not experienced many warm and trusting relationships with others.
- 17.\* I sometimes feel as if I've done all there is to do in life.
- 18.\*† In many ways, I feel disappointed about my achievements in life.

\*These items are reverse-scored so that higher scores correspond to greater psychological well-being. † These questions were selected for the Psychological Well-Being Index (PWBI).

## Appendix B.2 Life Satisfaction Scale

### **The Satisfaction with Life Scale**

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By Ed Diener, Ph.D.

DIRECTIONS: Below are five statements with which you may agree or disagree. Using the 1-7 scale below, indicate your agreement with each item by placing the appropriate number in the line preceding that item. Please be open and honest in your responding.

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Slightly Disagree
- 4 = Neither Agree or Disagree
- 5 = Slightly Agree
- 6 = Agree
- 7 = Strongly Agree

- \_\_\_\_\_ 1. In most ways my life is close to my ideal.
- \_\_\_\_\_ 2. The conditions of my life are excellent.
- \_\_\_\_\_ 3. I am satisfied with life.
- \_\_\_\_\_ 4. So far I have gotten the important things I want in life.
- \_\_\_\_\_ 5. If I could live my life over, I would change almost nothing.

## Appendix B.3 Brief Symptom Inventory-18

### BSI-18

**BSI-18.** Below is a list of statements of problems that people have sometimes. Please read each of them carefully and choose a number, depending on how much this problem has been bothered or upset you during the last week, including the current day.

How much you were annoyed by:

	Not at all	Slightly	Moderate	Very	Very much
01. Faintness or dizziness	0	1	2	3	4
02. Feeling no interest in things	0	1	2	3	4
03. Nervousness or shakiness inside	0	1	2	3	4
04. Pains in heart or chest	0	1	2	3	4
05. Feeling lonely	0	1	2	3	4
06. Feeling tense or keyed up	0	1	2	3	4
07. Nausea or upset stomach	0	1	2	3	4
08. Feeling blue	0	1	2	3	4
09. Suddenly scared for no reason	0	1	2	3	4
10. Trouble getting your breath	0	1	2	3	4
11. Feeling of worthlessness	0	1	2	3	4
12. Spells of terror or panic	0	1	2	3	4
13. Numbness or tingling in parts of your body	0	1	2	3	4
14. Feeling hopeless about the future	0	1	2	3	4
15. Feeling so restless you couldn't sit still	0	1	2	3	4
16. Feeling weak in parts of your body	0	1	2	3	4
17. Thoughts of ending your life	0	1	2	3	4
18. Feeling fearful	0	1	2	3	4

**Factor I. The Somatization dimension : 1, 4, 7, 10, 13, 16**

**Factor II. The depression dimension : 2, 5, 8, 11, 14, 17\***

**Factor III. Anxiety : 3, 6, 9, 12, 15, 18**

## Appendix B.4 Flourishing Scale

### **FLOURISHING SCALE**

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Below are 8 statements with which you may agree or disagree. Using the 1–7 scale below, indicate your agreement with each item by indicating that response for each statement.

- 7 - Strongly agree
- 6 - Agree
- 5 - Slightly agree
- 4 - Neither agree nor disagree
- 3 - Slightly disagree
- 2 - Disagree
- 1 - Strongly disagree

\_\_\_ I lead a purposeful and meaningful life

\_\_\_ My social relationships are supportive and rewarding

\_\_\_ I am engaged and interested in my daily activities

\_\_\_ I actively contribute to the happiness and well-being of others

\_\_\_ I am competent and capable in the activities that are important to me

\_\_\_ I am a good person and live a good life

\_\_\_ I am optimistic about my future

\_\_\_ People respect me

Scoring:

Add the responses, varying from 1 to 7, for all eight items. The possible range of scores is from 8 (lowest possible) to 56 (highest PWB possible). A high score represents a person with many psychological resources and strengths

## Appendix B.5 Scale of Positive and Negative Experience (SPANE)

### Scale of Positive and Negative Experience (SPANE)

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Please think about what you have been doing and experiencing during the past four weeks. Then report how much you experienced each of the following feelings, using the scale below. For each item, select a number from 1 to 5, and indicate that number on your response sheet.

1. Very Rarely or Never
2. Rarely
3. Sometimes
4. Often
5. Very Often or Always

Positive  
Negative  
Good  
Bad  
Pleasant  
Unpleasant  
Happy  
Sad  
Afraid  
Joyful  
Angry  
Contented

### Scoring:

The measure can be used to derive an overall affect balance score, but can also be divided into positive and negative feelings scales.

**Positive Feelings (SPANE-P):** Add the scores, varying from 1 to 5, for the six items: positive, good, pleasant, happy, joyful, and contented. The score can vary from 6 (lowest possible) to 30 (highest positive feelings score).

**Negative Feelings (SPANE-N):** Add the scores, varying from 1 to 5, for the six items: negative, bad, unpleasant, sad, afraid, and angry. The score can vary from 6 (lowest possible) to 30 (highest negative feelings score).

**Affect Balance (SPANE-B):** The negative feelings score is subtracted from the positive feelings score, and the resultant difference score can vary from -24 (unhappiest possible) to 24 (highest affect balance possible). A respondent with a very high score of 24 reports that she or he rarely or never experiences any of the negative feelings, and very often or always has all of the positive feelings.

## Appendix B.6 Mindful Attention Awareness Scale

Mindfulness Attention Awareness Scale (MAAS)

Please indicate the degree to which you agree with each of the following items using the scale below. Simply circle your response to each item.

	1	2	3	4	5	6
	almost always	very frequently	somewhat frequently	somewhat infrequently	very infrequently	almost never
1. I could be experiencing some emotion and not be conscious of it until some time later.	1	2	3	4	5	6
2. I break or spill things because of carelessness, not paying attention, or thinking of something else.	1	2	3	4	5	6
3. I find it difficult to stay focused on what's happening in the present.	1	2	3	4	5	6
4. I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	1	2	3	4	5	6
5. I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	1	2	3	4	5	6
6. I forget a person's name almost as soon as I've been told it for the first time.	1	2	3	4	5	6
7. It seems I am "running on automatic" without much awareness of what I'm doing.	1	2	3	4	5	6
8. I rush through activities without being really attentive to them.	1	2	3	4	5	6
9. I get so focused on the goal I want to achieve that I lose touch with what I am doing right now to get there.	1	2	3	4	5	6
10. I do jobs or tasks automatically, without being aware of what I'm doing.	1	2	3	4	5	6
11. I find myself listening to someone with one ear, doing something else at the same time.	1	2	3	4	5	6
12. I drive places on "automatic pilot" and then wonder why I went there.	1	2	3	4	5	6
13. I find myself preoccupied with the future or the past.	1	2	3	4	5	6
14. I find myself doing things without paying attention.	1	2	3	4	5	6
15. I snack without being aware that I'm eating.	1	2	3	4	5	6

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## Appendix B.7 Hope Scale

### The Trait Hope Scale

*Directions:* Read each item carefully. Using the scale shown below, please select the number that best describes YOU and put that number in the blank provided.

- 1. = Definitely False
- 2. = Mostly False
- 3. = Somewhat False
- 4. = Slightly False
- 5. = Slightly True
- 6. = Somewhat True
- 7. = Mostly True
- 8. = Definitely True

- \_\_\_ 1. I can think of many ways to get out of a jam.
- \_\_\_ 2. I energetically pursue my goals.
- \_\_\_ 3. I feel tired most of the time.
- \_\_\_ 4. There are lots of ways around any problem.
- \_\_\_ 5. I am easily downed in an argument.
- \_\_\_ 6. I can think of many ways to get the things in life that are important to me.
- \_\_\_ 7. I worry about my health.
- \_\_\_ 8. Even when others get discouraged, I know I can find a way to solve the problem.
- \_\_\_ 9. My past experiences have prepared me well for my future.
- \_\_\_ 10. I've been pretty successful in life.
- \_\_\_ 11. I usually find myself worrying about something.
- \_\_\_ 12. I meet the goals that I set for myself.

*Note.* When administering the scale, it is called The Future Scale. The agency subscale score is derived by summing items 2, 9, 10, and 12; the pathway subscale score is derived by adding items 1, 4, 6, and 8. The total Hope Scale score is derived by summing the four agency and the four pathway items.

## Appendix B.8 Revised Life Orientation Test (LOT-R)

### Revised Life Orientation Test (LOT-R)

#### Instructions:

Please answer the following questions about yourself by indicating the extent of your agreement using the following scale:

- [0] = strongly disagree
- [1] = disagree
- [2] = neutral
- [3] = agree
- [4] = strongly agree

Be as honest as you can throughout, and try not to let your responses to one question influence your response to other questions. There are no right or wrong answers.

- \_\_\_\_\_ 1. In uncertain times, I usually expect the best.
- \_\_\_\_\_ 2. It's easy for me to relax.
- \_\_\_\_\_ 3. If something can go wrong for me, it will.
- \_\_\_\_\_ 4. I'm always optimistic about my future.
- \_\_\_\_\_ 5. I enjoy my friends a lot.
- \_\_\_\_\_ 6. It's important for me to keep busy.
- \_\_\_\_\_ 7. I hardly ever expect things to go my way.
- \_\_\_\_\_ 8. I don't get upset too easily.
- \_\_\_\_\_ 9. I rarely count on good things happening to me.
- \_\_\_\_\_ 10. Overall, I expect more good things to happen to me than bad.

#### Scoring:

1. Reverse code items 3, 7, and 9 prior to scoring (0=4) (1=3) (2=2) (3=1) (4=0).
2. Sum items 1, 3, 4, 7, 9, and 10 to obtain an overall score.

*Note:* Items 2, 5, 6, and 8 are filler items only. They are not scored as part of the revised scale.

The revised scale was constructed in order to eliminate two items from the original scale, which dealt more with coping style than with positive expectations for future outcomes. The correlation between the revised scale and the original scale is .95.

#### Reference:

Scheier, M.F., Carver, C.S., and Bridges, M.W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A re-evaluation of the Life Orientation Test. *Journal of Personality and Social Psychology*, *67*, 1063-1078.

## Appendix B.9 Subjective Happiness Scale

### Subjective Happiness Scale (SHS)

---

By Sonja Lyubomirsky, Ph.D.

For each of the following statements and/or questions, please circle the point on the scale that you feel is most appropriate in describing you.

1. In general, I consider myself:

1	2	3	4	5	6	7
not a very happy person						a very happy person

2. Compared to most of my peers, I consider myself:

1	2	3	4	5	6	7
less happy						more happy

3. Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. To what extent does this characterization describe you?

1	2	3	4	5	6	7
not at all						a great deal

4. Some people are generally not very happy. Although they are not depressed, they never seem as happy as they might be. To what extent does this characterization describe you?

1	2	3	4	5	6	7
not at all						a great deal

Note: Item #4 is reverse coded.

## Appendix B.10 Gratitude Questionnaire

### The Gratitude Questionnaire-Six Item Form (GQ-6)

---

By Michael E. McCullough, Ph.D., Robert A. Emmons, Ph.D., Jo-Ann Tsang, Ph.D.

Using the scale below as a guide, write a number beside each statement to indicate how much you agree with it.

- 1 = strongly disagree
- 2 = disagree
- 3 = slightly disagree
- 4 = neutral
- 5 = slightly agree
- 6 = agree
- 7 = strongly agree

- \_\_\_ 1. I have so much in life to be thankful for.
- \_\_\_ 2. If I had to list everything that I felt grateful for, it would be a very long list.
- \_\_\_ 3. When I look at the world, I don't see much to be grateful for.\*
- \_\_\_ 4. I am grateful to a wide variety of people.
- \_\_\_ 5. As I get older I find myself more able to appreciate the people, events, and situations that have been part of my life history.
- \_\_\_ 6. Long amounts of time can go by before I feel grateful to something or someone.\*

\* Items 3 and 6 are reverse-scored.

## Appendix C Application Development Documentation

The following sections describe the project's structure in android studio and present the source code for critical functions of the application.

### Project Structure

The module *app* contains the folders *manifests*, *java* and *res*. The *manifest* folder contains the *AndroidManifest.xml* file. This file contains essential information about the application such as minimum Android version, the application java package, and the application components. The *java* folder contains all java source code files. Its organization is presented in *Figure 39*.

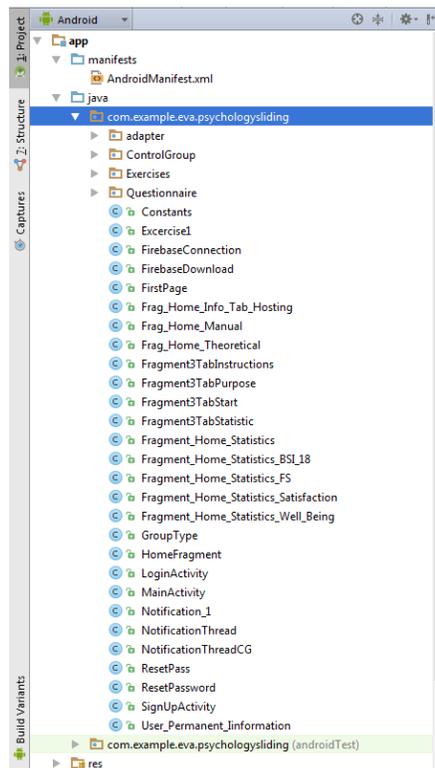
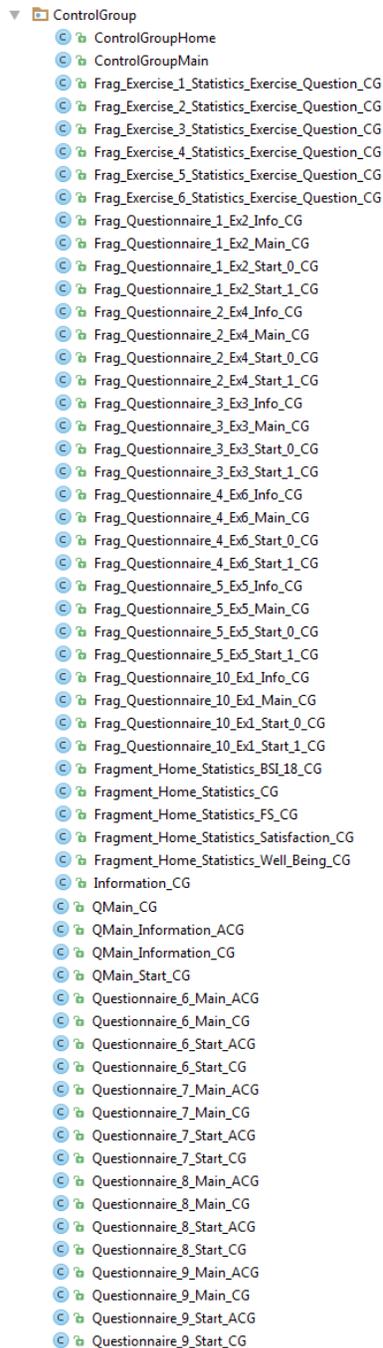


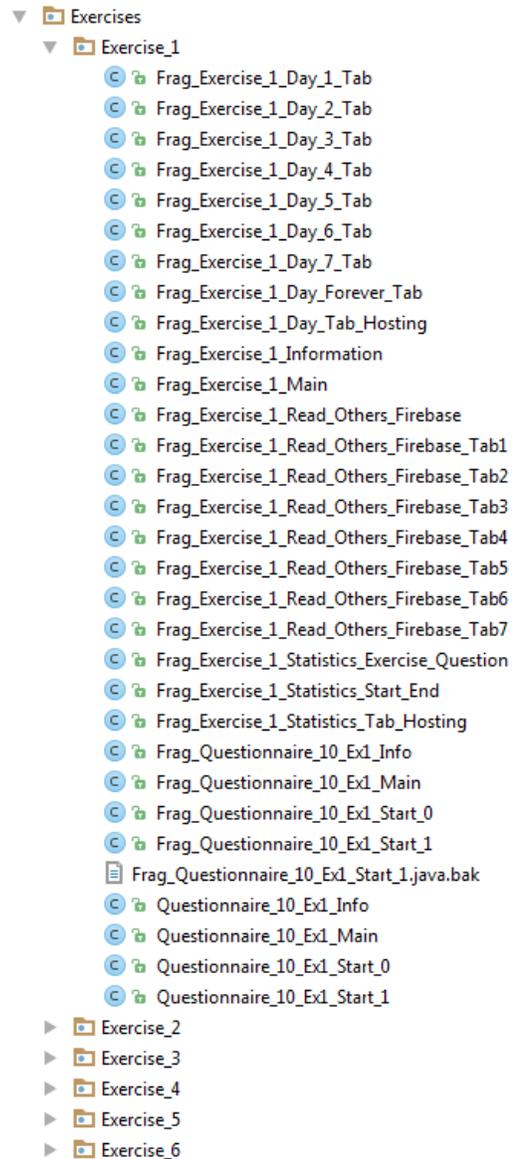
Figure 39: java folder

The package *ControlGroup* contains all java files for the second mode of the application (Group 2) (see *Figure 40*).



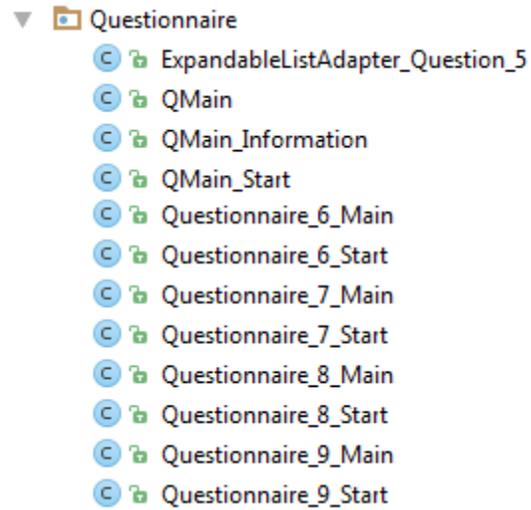
**Figure 40:** *ControlGroup* package

The package *exercises* contains one package for each one of the exercise files as it can be seen in *Figure 41*.



**Figure 41:** *exercises* package

Finally, the package *Questionnaire* contains the java files for the wellbeing assessment (see *Figure 42*).



**Figure 42:** *Questionnaire* package

Finally, the res folder contains all resources files such as images, layouts and values.

## Source Code

This section gives a brief description of some basic java classes and presents the source code of critical functions of the application.

### *FirstPage Activity*

The *FirstPage* activity (FirstPage.java file) is the first activity that runs when a user starts the application. It contains *Sign Up* and *Login* buttons which call *Sign Up* activity and *Login* activity respectively.

```
sign_in.setOnClickListener(new View.OnClickListener() {
    @Override
    public void onClick(View v) {

        loadLoginView();

    }
});
sign_up.setOnClickListener(new View.OnClickListener() {
    @Override
    public void onClick(View v) {

        loadSignUpView();

    }
});
```

```
// Start Login
private void loadLoginView() {
    Intent intent = new Intent(FirstPage.this, LoginActivity.class);
    intent.addFlags(Intent.FLAG_ACTIVITY_NEW_TASK);
    intent.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TASK);
    startActivity(intent);
}
// End Login

//Start Sign Up
private void loadSignUpView() {
    Intent intent = new Intent(FirstPage.this, SignUpActivity.class);
    intent.addFlags(Intent.FLAG_ACTIVITY_NEW_TASK);
    intent.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TASK);
    startActivity(intent);
}
//End Sign Up
```

## Sign Up Activity

The *Sign Up* activity (*SignUpActivity.java* file) contains the code for Sign up. It asks the user to enter an email and a password. After the user has pressed the button *Sign Up* the *Sign Up* activity reads the email and the password that the user has entered, then it checks if the user has entered his/her email and password or not. If the user hasn't input email or password, he/she is informed by an alert dialog to do it, else it runs the sign up process. If the sign up process is successful the activity calls the *Login* activity.

```
String password = passwordEditText.getText().toString();
String email = emailEditText.getText().toString();

password = password.trim();
email = email.trim();

if (password.isEmpty() || email.isEmpty()) {
    AlertDialog.Builder builder = new AlertDialog.Builder(SignUpActivity.this);
    builder.setMessage(R.string.signup_error_message)
        .setTitle(R.string.error)
        .setPositiveButton(android.R.string.ok, null);
    AlertDialog dialog = builder.create();
    dialog.show();
} else {

    // sign up
    Firebase cuRef=rootRef.child("Users/CommonUsers");
    cuRef.createUser(email, password, new Firebase.ResultHandler() {
        @Override
        public void onSuccess() {
            AlertDialog.Builder builder = new AlertDialog.Builder(SignUpActivity.this);
            builder.setMessage(R.string.signup_success)
                .setPositiveButton(R.string.login_button_label, new DialogInterface.OnClickListener() {
                    @Override
                    public void onClick(DialogInterface dialogInterface, int i) {
                        Intent intent = new Intent(SignUpActivity.this, LoginActivity.class);
                        intent.addFlags(Intent.FLAG_ACTIVITY_NEW_TASK);
                        intent.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TASK);
                        startActivity(intent);
                    }
                });
            AlertDialog dialog = builder.create();
            dialog.show();
        }

        @Override
        public void onError(FirebaseError firebaseError) {
            AlertDialog.Builder builder = new AlertDialog.Builder(SignUpActivity.this);
            builder.setMessage(firebaseError.getMessage())
                .setTitle("Error!")
                .setPositiveButton(android.R.string.ok, null);
            AlertDialog dialog = builder.create();
            dialog.show();
        }
    });
}
```

## *Login Activity*

The *Login* activity (*LoginActivity.java* file) reads the email and the password the user has entered, then it checks if the user has entered his/her email and password or not. If the user hasn't input email or password he/she is informed by an alert dialog to do it, else it runs the login process.

```
final String emailAddress = email;

//Login with an email & password combination
cuRef = ref.child("Users/CommonUsers");
ref.authWithPassword(email, password, new FirebaseAuthHandler() {
    @Override
    public void onAuthenticated(final AuthData authData) {
        mUserId = cuRef.getAuth().getUid();

        cuRef.addValueEventListener(new ValueEventListener() {
            @Override
            public void onDataChange(DataSnapshot snapshot) {
                boolean em = snapshot.child("Email").exists();
                if (!em) {
                    Map<String, Object> map = new HashMap<>();
                    map.put("Email", emailAddress);
                    ref.child("Users/CommonUsers").child(authData.getUid()).updateChildren(map);
                    System.out.println(emailAddress);
                } else {
                    System.out.println("To email yparxei");
                }
            }
        });

        @Override
        public void onCancelled(FirebaseError firebaseError) {
        }
    }
});
```

After the user has logged in the *Login* activity it checks if the user has completed his/her personal data, if not it calls the *User\_Permanent\_Information* activity in order the user to complete his/her personal data. Then, it checks if the user has joined in a group, if not it calls the *GroupType* activity in order for the user to select to join in one of the two supplied group. If the user has selected *Group 1* it calls the *MainActivity* activity, if he/she has selected *Group 2* it calls the *ControlGroupMain* activity.

## MainActivity Activity

The *MainActivity* activity starts a notification thread, which checks what is the following task that the connected user has to perform and sends notification to the user.

```
nthread = new NotificationThread(getApplicationContext());  
nthread.start();
```

Then, it checks if the user has completed the baseline measurement in *Wellbeing Assessment Questionnaire*, if not it calls the *QMain\_Start* activity, else it reads from Firebase the dates that each *Wellbeing Assessment* measurement (measurements 1- 12) starts, it compares these dates with the current date and time and sets a value from 1 to 12 to *mUserId* counter in *Times\_Counter* folder in Firebase. The *mUserId* counter is checked in *QMain* activity. Additionally, it reads the exercises' titles from Firebase and put them in an *ArrayAdapter*. Then it puts the values that have entered in *ArrayAdapter* in a *Listview* in order to show them in the *Navigation Drawer* menu.

```
titleRef = rootRef.child("Titles_Eng");  
titleRef.addValueEventListener(new ValueEventListener() {  
    @Override  
    public void onDataChange(DataSnapshot dataSnapshot) {  
        Map<String, String> map = dataSnapshot.getValue(Map.class);  
        title0 = map.get("title_home");  
        title1 = map.get("title_ex1");  
        title2 = map.get("title_ex2");  
        title3 = map.get("title_ex3");  
        title4 = map.get("title_ex4");  
        title5 = map.get("title_ex5");  
        title6 = map.get("title_ex6");  
  
        navArray = new ArrayList<String>();  
        navArray.add(title0);  
        navArray.add(title1);  
        navArray.add(title2);  
        navArray.add(title3);  
        navArray.add(title4);  
        navArray.add(title5);  
        navArray.add(title6);  
  
        mDrawerList.setChoiceMode(ListView.CHOICE_MODE_SINGLE);  
        adapter1 = new ArrayAdapter<String>(getApplicationContext(), android.R.layout.simple_list_item_activated_1, navArray);  
        mDrawerList.setOnItemClickListener(new SlideMenuClickListener());  
        mDrawerList.setAdapter(adapter1);  
  
        getActionBar().setTitle(title0);  
    }  
  
    @Override  
    public void onCancelled(FirebaseError firebaseError) {  
    }  
});
```

So, by selecting one of the *Navigation Drawer* menu selections it calls the App's Home Page, or the Main Exercise's page fragment depending on the selection.

```
switch (position) {
    case 0:
        fragment = new HomeFragment();
        setTitle(tTitle0);
        break;
    case 1:
        fragment = new Frag_Exercise_1_Main();
        setTitle(tTitle1);
        break;
    case 2:
        fragment = new Frag_Exercise_2_Main();
        setTitle(title2);
        break;
    case 3:
        fragment = new Frag_Exercise_3_Main();
        setTitle(title3);
        break;
    case 4:
        fragment = new Frag_Exercise_4_Main();
        setTitle(title4);
        break;
    case 5:
        fragment = new Frag_Exercise_5_Main();
        setTitle(title5);
        break;
    case 6:
        fragment = new Frag_Exercise_6_Main();
        setTitle(title6);
        break;
    default:
        break;
}
```

### ***QMain\_Start Activity***

The *QMain\_Start* activity checks if in *DatesFolder* in Firebase there is a record for baseline measurement, if not it calls the *datetime* void which reads the current date and time and then it estimates the expire date for baseline measurement (two days later). Furthermore, it estimates the dates and times for measurements 1 to 12 and adds records in *DatesFolder* in Firebase.

```

private void datetime() {
    //μετρώ την τρέχουσα ώρα
    Calendar today = Calendar.getInstance();
    String datec = "" + today.get(Calendar.DAY_OF_MONTH) + ":" + today.get(Calendar.MONTH) + ":" + today.get(Calendar.YEAR);
    String timec = "" + today.get(Calendar.HOUR_OF_DAY) + ":" + today.get(Calendar.MINUTE) + ":" + today.get(Calendar.SECOND);
    System.out.println("Απο το Ερωτηματολόγιο - τρέχουσα μέρα " + datec);
    System.out.println("Απο το Ερωτηματολόγιο - τρέχουσα ώρα " + timec);
    //Μετατρέπω την τρέχουσα ώρα σε time_0_StartInMilliseconds και την αποθηκεύω
    long time_0_StartInMilliseconds = today.getTimeInMillis();
    //Υπολογίζω πόσο είναι 48 ώρες μετά
    long millisIn48Hours = 1000 * 60 * 60 * 48;
    System.out.println("Πόσο είναι 48 ώρες σε time_0_StartInMilliseconds " + millisIn48Hours);
    long time_0_Exp_InMilliseconds = time_0_StartInMilliseconds + millisIn48Hours;
    System.out.println("To time_0_Exp_InMilliseconds σε time_0_StartInMilliseconds " + time_0_Exp_InMilliseconds);
    // Υπολογίζω την ημερομηνία και ώρα λήξης (48 ώρες μετά)
    Calendar ca = Calendar.getInstance();
    ca.setTimeInMillis(time_0_Exp_InMilliseconds);
    String date = "" + ca.get(Calendar.DAY_OF_MONTH) + ":" + ca.get(Calendar.MONTH) + ":" + ca.get(Calendar.YEAR);
    String time = "" + ca.get(Calendar.HOUR_OF_DAY) + ":" + ca.get(Calendar.MINUTE) + ":" + ca.get(Calendar.SECOND);
    Map<String, Object> startTime = new HashMap<>();
    startTime.put("Time_0_Start_In_msec", time_0_StartInMilliseconds);
    startTime.put("Time_0_Expire_In_msec", time_0_Exp_InMilliseconds);
    qDateStartComplete.child(mUserId).updateChildren(startTime);
    //Υπολογίζω την ημερομηνία μετρήσης μετά την ολοκλήρωση των ασκήσεων
    Calendar call = Calendar.getInstance();
    call.add(Calendar.DATE, 45 );
    String date11 = "" + call.get(Calendar.DAY_OF_MONTH) + ":" + call.get(Calendar.MONTH) + ":" + call.get(Calendar.YEAR);
    String time11 = "" + call.get(Calendar.HOUR_OF_DAY) + ":" + call.get(Calendar.MINUTE) + ":" + call.get(Calendar.SECOND);
    long currentstart1 = call.getTimeInMillis();
    Map<String, Object> dt1 = new HashMap<>();
    dt1.put("Time_1_Start_In_msec", currentstart1);
    qDateStartComplete.child(mUserId).updateChildren(dt1);
    int h = 0;
    for (int i = 2; i <= 12; i++) {
        String itostring = String.valueOf(i);
        String makeday = "Time_ " + itostring + "_Start_In_msec";
        Calendar cal = Calendar.getInstance();
        cal.add(Calendar.DATE, (45+(30*(i-1))));
        String date1 = "" + cal.get(Calendar.DAY_OF_MONTH) + ":" + cal.get(Calendar.MONTH) + ":" + cal.get(Calendar.YEAR);
        String time1 = "" + cal.get(Calendar.HOUR_OF_DAY) + ":" + cal.get(Calendar.MINUTE) + ":" + cal.get(Calendar.SECOND);
        long currentstart = cal.getTimeInMillis();
        Map<String, Object> dt = new HashMap<>();
        dt.put(makeday, currentstart);
        qDateStartComplete.child(mUserId).updateChildren(dt);
    }
}

```

It checks if the current date and time is later than the expired date and time for the baseline measurement and if the four questionnaires are not completed, it informs the user that his/her entries will be deleted, it deletes the user entries for the baseline measurement and calls the *datetime* void.

```

if ((nowTimeInMilliseconds > expday) & (!q1||!q2||!q3||!q4)) {
    rootRef.child("Users/CommonUsers/" + mUserId).addListenerForSingleValueEvent(new ValueEventListener() {
        @Override
        public void onDataChange(DataSnapshot dataSnapshot) {
            Map<String, String> map = dataSnapshot.getValue(Map.class);
            nick = map.get("Nickname");
            System.out.println("nickname " + nick);
            //Στέλνω ενημερωτικό
            LayoutInflater q7complete = LayoutInflater.from(QMain_Start.this);
            View dialogViewEdit = q7complete.inflate(R.layout.custom_start_button_dialog, null);
            final AlertDialog.Builder alertDialogBuilderEdit = new AlertDialog.Builder(
                new ContextThemeWrapper(QMain_Start.this, R.style.myDialog));
            alertDialogBuilderEdit.setView(dialogViewEdit);
            alertDialogBuilderEdit.setMessage("Your records have been deleted because the questionnaire is overdue.");
            alertDialogBuilderEdit
                .setCancelable(false)
                .setPositiveButton("OK", new DialogInterface.OnClickListener() {
                    @Override
                    public void onClick(DialogInterface dialog, int which) {
                        dialog.cancel();
                    }
                });

            // show it
            final AlertDialog alertDialog = alertDialogBuilderEdit.create();
            alertDialog.show();
        }

        @Override
        public void onCancelled(FirebaseError firebaseError) {

        }
    });
    //Διέγραψε εγγραφές
    Firebase q6 = rootRef.child("Data/QuestionnaireAnswers/QMain/Question_6/Measurement_0");
    q6.child(mUserId).removeValue();
    Firebase q7 = rootRef.child("Data/QuestionnaireAnswers/QMain/Question_7/Measurement_0");
    q7.child(mUserId).removeValue();
    Firebase q8 = rootRef.child("Data/QuestionnaireAnswers/QMain/Question_8/Measurement_0");
    q8.child(mUserId).removeValue();
    Firebase q9 = rootRef.child("Data/QuestionnaireAnswers/QMain/Question_9/Measurement_0");
    q9.child(mUserId).removeValue();
    Firebase complete = rootRef.child("Data/QuestionnaireAnswers/QMain/Complete/Measurement_0");
    complete.child(mUserId).removeValue();
    //Επαναυπολόγισε
    Satetime();
}

```

Each questionnaire corresponds to one of the buttons that are presented in *Wellbeing Assessment* layout (*qmain\_start.xml* file).

```

//Start - Questionnaire 6
button1.setOnClickListener(new View.OnClickListener() {
    @Override
    public void onClick(View v) {
        Intent b1 = new Intent(QMain_Start.this, Questionnaire_6_Main.class);
        startActivity(b1);
    }
});
//End - Questionnaire 6

```

Additionally, it checks if a questionnaire is completed and ticks the button that matches with this questionnaire.

```
if (q1) {  
    button1.setText("1st ✓");  
    button1.setBackgroundColor(Color.parseColor("#ebebff"));  
    button1.setEnabled(false);  
}
```

Likewise, it calculates the questionnaires' completion percentage and shows it in the progress bar.

```
String per = showInpB + " %";  
tvPercent.setText(per);  
progressBar.setProgress(showInpB);
```

Finally, after the user has completed the four questionnaires it calls the *MainActivity* activity.

### ***HomeFragment Fragment***

The *HomeFragment* fragment contains a *Floating Action Button* menu which calls the *Wellbeing Assessment Questionnaires (QMain activity)* activity, *Wellbeing Assessment Statistics (Fragment\_Home\_Statistics fragment)*, and *Instructions (Frag\_Home\_Info\_Tab\_Hosting fragment)*.

```
//Starts FAB Menu  
final FrameLayout frameLayout = (FrameLayout) rootView.findViewById(R.id.mframe_layout);  
frameLayout.getBackground().setAlpha(0);  
final FloatingActionsMenu fabMenu = (FloatingActionsMenu) rootView.findViewById(R.id.fab_menu);  
fabMenu.setOnFloatingActionsMenuUpdateListener(new FloatingActionsMenu.OnFloatingActionsMenuUpdateListener() {  
    @Override  
    public void onMenuExpanded() {  
        frameLayout.getBackground().setAlpha(240);  
        frameLayout.setOnTouchListener(new View.OnTouchListener() {  
            @Override  
            public boolean onTouch(View v, MotionEvent event) {  
                fabMenu.collapse();  
                return true;  
            }  
        });  
    }  
    @Override  
    public void onMenuCollapsed() {  
        frameLayout.getBackground().setAlpha(0);  
        frameLayout.setOnTouchListener(null);  
    }  
});  
//End FAB Menu  
  
//Start IFloating Action Button Statistics  
FloatingActionButton fabStatistics = (FloatingActionButton) rootView.findViewById(R.id.fabHomeStatistics);  
  
fabStatistics.setOnLongClickListener((v) -> {  
    Toast.makeText(getContext(), "Wellbeing Assessment Statistics", Toast.LENGTH_SHORT).show();  
    return false;  
});  
  
fabStatistics.setOnClickListener(new View.OnClickListener() {  
    @Override  
    public void onClick(View v) {  
        getFragmentManager()  
            .beginTransaction()  
            .replace(R.id.frame_container, new Fragment_Home_Statistics())  
            .addToBackStack(null)  
            .commit();  
    }  
});  
//End Floating Action Button Statistics
```

## *QMain Activity*

The *QMain* activity reads the *mUserId* counter in *Times\_Counter* folder in Firebase and calls the private measurement void that has been defined for each measurement respectively.

```
String uID = mUserId;
Map<String, Integer> cmap = dataSnapshot.getValue(Map.class);
Integer questTimesCounterIs = cmap.get(uID);
```

Each void performs the same functions that *QMain\_Start* activity performs as far as the questionnaires completion is concerned.

## **Fragment\_Home\_Statistics Fragment**

This fragment contains a scrolling tab menu in order to present in separate layouts the scores obtained from the four questionnaires for well-being assessment.

```
@Override
public View onCreateView(LayoutInflater inflater, ViewGroup container,
                        Bundle savedInstanceState) {

    View rootView = inflater.inflate(R.layout.fragment_home_statistics_tab_hosting, container, false);

    Bundle bundle = this.getArguments();
    mTabHost = (FragmentTabHost) rootView
        .findViewById(android.R.id.tabhost);
    widget = (TabWidget) rootView.findViewById(android.R.id.tabs);
    hs = (HorizontalScrollView) rootView
        .findViewById(R.id.horizontalScrollView);
    mTabHost.setup(getActivity(), getChildFragmentManager(),
        android.R.id.tabcontent);

    initView(rootView);

    return rootView;
}

private void initView(View rootView) {

    mTabHost.addTab(mTabHost.newTabSpec("WELL-BEING").setIndicator("WELL-BEING"),
        Fragment_Home_Statistics_Well_Being.class, null);
    mTabHost.addTab(mTabHost.newTabSpec("PSYCHOL/L \nSYMPTOMS").setIndicator("PSYCHOL/L \nSYMPTOMS"),
        Fragment_Home_Statistics_BSI_18.class, null);
    mTabHost.addTab(mTabHost.newTabSpec("LIFE \nSATISFAC/N").setIndicator("LIFE \nSATISFAC/N"),
        Fragment_Home_Statistics_Satisfaction.class, null);
    mTabHost.addTab(mTabHost.newTabSpec("FLOURISHING").setIndicator("FLOURISHING"),
        Fragment_Home_Statistics_FS.class, null);
}
```

### *Fragment\_Home\_Statistics\_Well\_Being\_Fragment*

This fragment reads the title and the explanations about the *Well-being Assessment* questionnaire from Firebase and present them in the layout. It reads the user's answers for each measurement from Firebase and calculates the scores. Then, it presents the total score in one graph and the sub scores in the other graph. The following code presents how a score is shown in a graph.

```
Viewport viewport = graph.getViewport();
viewport.setYAxisBoundsManual(true);
viewport.setMinY(7);
viewport.setMaxY(126);
viewport.setXAxisBoundsManual(true);
viewport.setMinX(0);
viewport.setMaxX(12);
viewport.setScrollable(true);
LineGraphSeries<DataPoint> series = new LineGraphSeries<DataPoint>(new DataPoint[]{
    new DataPoint(0, totalScore_0),
});

graph.addSeries(series);
series.setTitle("Overall ");
series.setColor(getResources().getColor(android.R.color.holo_green_light));
series.setDrawDataPoints(true);
series.setDataPointsRadius(4);
series.setThickness(3);

graph.setTitleColor(getResources().getColor(android.R.color.holo_green_light));
GridLabelRenderer gridLabel = graph.getGridLabelRenderer();
gridLabel.setHorizontalAxisTitle("Measurement Number");
graph.getLegendRenderer().setVisible(true);
graph.getLegendRenderer().setAlign(LegendRenderer.LegendAlign.TOP);
StaticLabelsFormatter staticLabelsFormatter = new StaticLabelsFormatter(graph);
graph.getGridLabelRenderer().setLabelFormatter(staticLabelsFormatter);
```

By tapping on a graph the scores are indicated in numbers in an alert dialog.

```

graph.setOnClickListner(new View.OnClickListener() {
    @Override
    public void onClick(View v) {
        LayoutInflater q1complete = LayoutInflater.from(getContext());
        View dialogViewEdit = q1complete.inflate(R.layout.custom_start_button_dialog, null);
        AlertDialog.Builder alertDialogBuilderEdit = new AlertDialog.Builder(
            new ContextThemeWrapper(getContext(), R.style.myDialog));
        alertDialogBuilderEdit.setView(dialogViewEdit);

        alertDialogBuilderEdit.setTitle("Well-bieng");

        alertDialogBuilderEdit.setMessage("Measurement: Baseline \n\nOverall: " + totalScore_0);

        alertDialogBuilderEdit
            .setCancelable(false)
            .setPositiveButton("OK",
                (dialog, id) -> {

                    dialog.cancel();
                    dialog.dismiss();

                });

        AlertDialog alertDialog = alertDialogBuilderEdit.create();
        // show it
        alertDialog.show();
    }
});

```

### *NotificationThread Thread*

The notification thread runs every time a user is logged in the application and every four hours if the application runs.

```
Thread.sleep(4 * 60 * 60 * 1000);
```

It performs various checks and sends personalised notifications to users informing them about the next task they have to complete. The following code presents how a notification message is sent.

```

NotificationManager notificationManager;
Notification myNotification;
Intent myIntent = new Intent(mContext, FirebaseConnection.class);
PendingIntent pendingIntent = PendingIntent.getActivity(
    mContext,
    0,
    myIntent,
    Intent.FILL_IN_DATA);
String message1 = nick + " the Day 1, you entered " + day_1_counter + " entries. " +
    "The latest at " + new DecimalFormat("##.##").format(restHours) + " hours you should have entered 3 entries.";

myNotification = new NotificationCompat.Builder(mContext)
    .setContentTitle("Three Good Things")
    .setStyle(new NotificationCompat.BigTextStyle().bigText(message1))
    .setContentText(nick + " the Day 1, you entered " + day_1_counter + " entries. The latest at " +
        new DecimalFormat("##.##").format(restHours) + " hours you should have entered 3 entries.")
    .setTicker("Notification!")
    .setWhen(System.currentTimeMillis())
    .setContentIntent(pendingIntent)
    .setDefaults(Notification.DEFAULT_SOUND)
    .setAutoCancel(true)
    .setPriority(7)
    .setSmallIcon(R.drawable.ic_launcher)
    .setContentText(message1)
    .build();
System.out.println(message1);

notificationManager =
    (NotificationManager) mContext.getSystemService(Context.NOTIFICATION_SERVICE);
notificationManager.notify(1, myNotification);

```

Due to technical reasons (size) the *NotificationThread* class had to be split in two files. A new notification thread file *Notification\_1* thread was created. Voids from *Notification\_1* thread are called from the *NotificationThread* thread class. An example is presented in the following code.

```

Notification_1 qn1 = new Notification_1(mContext);
qn1.checkForMainExpireN1();

```

### ***Frag\_Exercise\_1\_Main Fragment***

The *Frag\_Exercise\_1\_Main* fragment reads the purpose, the duration and the terms of first exercise from Firebase and presents them in exercise's main page layout.

```

exerciselRef = rootRef.child("Exercises_Eng/Ex_1");
exerciselRef.addValueEventListener(new ValueEventListener() {
    @Override
    public void onDataChange(DataSnapshot dataSnapshot) {
        Map<String, String> map = dataSnapshot.getValue(Map.class);
        ex1Duration = map.get("Duration");
        ex1Purpose = map.get("Purpose");
        ex1Terms = map.get("Terms");

        //Start set values to TextViews
        String p = ("<b>" + "Purpose: " + "</b>");
        purposeV.setText(Html.fromHtml(p + ex1Purpose));

        String d = ("<b>" + "Duration: " + "</b>");
        durationTV.setText(Html.fromHtml(d + ex1Duration));

        String t = ("<b>" + "Time Limitation: " + "</b>");
        termsV.setText(Html.fromHtml(t + ex1Terms));
        //End set values to TextViews
    }

    @Override
    public void onCancelled(FirebaseError firebaseError) {

    }
});

```

### Frag\_Exercise\_1\_Day\_Tab\_Hosting Fragment

This fragment contains a scrolling tab menu that presents the days layouts. It checks the state of the exercise and presents the dates in a proper way. If the exercise is active, it reads the dates that each day is active from Firebase and presents it in a scrolling tab menu. The following code presents the controls about first, second and third day.

```

if (nowDateandTimeInMilliseconds > day_1_open && nowDateandTimeInMilliseconds < (day_1_open + (24 * 60 * 60 * 1000))) {
    mTabHost.clearAllTabs();
    mTabHost.addTab(mTabHost.newTabSpec("DAY 1").setIndicator("DAY 1"),
        Frag_Exercise_1_Day_1_Tab.class, null);
} else if (nowDateandTimeInMilliseconds > day_2_open && nowDateandTimeInMilliseconds < (day_2_open + (24 * 60 * 60 * 1000))) {
    if (mTabHost != null) {
        mTabHost.clearAllTabs();
    }

    mTabHost.addTab(mTabHost.newTabSpec("DAY 2").setIndicator("DAY 2"),
        Frag_Exercise_1_Day_2_Tab.class, null);
    mTabHost.addTab(mTabHost.newTabSpec("DAY 1").setIndicator("DAY 1"),
        Frag_Exercise_1_Day_1_Tab.class, null);
} else if (nowDateandTimeInMilliseconds > day_3_open && nowDateandTimeInMilliseconds < (day_3_open + (24 * 60 * 60 * 1000))) {
    if (mTabHost != null) {
        mTabHost.clearAllTabs();
    }

    mTabHost.addTab(mTabHost.newTabSpec("DAY 3").setIndicator("DAY 3"),
        Frag_Exercise_1_Day_3_Tab.class, null);
    mTabHost.addTab(mTabHost.newTabSpec("DAY 2").setIndicator("DAY 2"),
        Frag_Exercise_1_Day_2_Tab.class, null);
    mTabHost.addTab(mTabHost.newTabSpec("DAY 1").setIndicator("DAY 1"),
        Frag_Exercise_1_Day_1_Tab.class, null);
} else if (nowDateandTimeInMilliseconds > day_4_open && nowDateandTimeInMilliseconds < (day_4_open + (24 * 60 * 60 * 1000))) {
    if (mTabHost != null) {

```

## Frag\_Exercise\_1\_Day\_1\_Tab Fragment

The *Frag\_Exercise\_1\_Day\_1\_Tab* fragment does a series of checks as far as day one is concerned such as if a user has answered the subjective assessment question before starting the exercise and if the user has entered the three inputs. The following code presents the *Dialog* for the subjective assessment question.

```
if (!qStartUID) {
    Firebase readEx1StartEndQuestion = rootRef.child("Exercises_Eng/Ex_1");
    readEx1StartEndQuestion.addListenerForSingleValueEvent(new ValueEventListener() {
        @Override
        public void onDataChange(DataSnapshot dataSnapshot) {
            rankDialog = new Dialog(getContext(), R.style.Dialog);
            rankDialog.setContentview(R.layout.rank_dialog);
            rankDialog.setCancelable(true);
            ratingBar = (RatingBar) rankDialog.findViewById(R.id.dialog_ratingbar);
            ratingBar.setRating(1);
            Drawable drawable = ratingBar.getProgressDrawable();
            drawable.setColorFilter(Color.parseColor("#FF4081"), PorterDuff.Mode.SRC_ATOP);
            TextView text = (TextView) rankDialog.findViewById(R.id.rank_dialog_text1);
            text.setText("Before you start ...");
            infText = (TextView) rankDialog.findViewById(R.id.info);
            Map<String, String> ex1q = dataSnapshot.getValue(Map.class);
            ex1StartEndQ = ex1q.get("Question_Start_End");
            final String p = ex1StartEndQ;
            infText.setText(nick + ", before undertake the exercise, please answer the following question: \n\n" + ex1StartEndQ);
            FloatingActionButton updateButton = (FloatingActionButton) rankDialog.findViewById(R.id.rank_dialog_button);
            startQuestion = 0;
            ratingBar.setOnRatingBarChangeListener(new RatingBar.OnRatingBarChangeListener() {
                public void onRatingChanged(RatingBar ratingBar, float rating, boolean fromUser) {
                    answerValue = String.valueOf(ratingBar.getRating()); // Get the Rating Here
                    showRate = (TextView) rankDialog.findViewById(R.id.rate);
                    showRate.setText(answerValue);
                    Float x = new Float(answerValue);
                    startQuestion = x.intValue();
                }
            });
            updateButton.setOnClickListener(new View.OnClickListener() {
                @Override
                public void onClick(View v) {
                    if (startQuestion != 0) {
                        final Firebase questionStartPath = rootRef.child("Data/Exercises_Question_Start_End/Question_Start/Exercise_1");
                        questionStartPath.addListenerForSingleValueEvent(new ValueEventListener() {
                            @Override
                            public void onDataChange(DataSnapshot dataSnapshot) {
                                Map<String, Object> stq = new HashMap<>();
                                stq.put(mUserId, startQuestion);
                                questionStartPath.updateChildren(stq);
                            }
                            @Override
                            public void onCancelled(FirebaseError firebaseError) {
                            }
                        });
                    }
                }
            });
            rankDialog.show();
        }
        @Override
        public void onCancelled(FirebaseError firebaseError) {
        }
    });
}
```

Additionally, it makes functions such as it inserting records in Firebase, and then showing them in a *Listview*. It also includes functions which allow users to modify the submitted records.

The following code shows how new entries are saved.

```

if (text.isEmpty()) {
    dialog.cancel();
} else {
    fullpath = "Data/Exercises/Exercise_1/Day_1/" + mUserId;
    crootRef = rootRef.child(fullpath);
    // Start 1. Read Counter and add 1
    crootRef.addListenerForSingleValueEvent(new ValueEventListener() {
        @Override
        public void onDataChange(DataSnapshot dataSnapshot) {
            // It reads the counter
            Map<String, Integer> count = dataSnapshot.getValue(Map.class);
            String s = dataSnapshot.getRef().toString();
            day_counter = count.get("Counter");
            day_counter++;
            Map<String, Object> userEntryDay1 = new HashMap<String, Object>();
            day_con = String.valueOf(day_counter);
            String t = "Post" + day_con;
            if (checkBoxShare.isChecked()) {
                newEntryText = "Shared" + "\n" + "Nickname: " + nick + "\n" + Html.fromHtml("<b>Date: </b>") + strDate + "\n" + Html.fromHtml("<b>Post number: </b>") + day_con + "\n\n" + text;
            } else {
                newEntryText = "Nickname: " + nick + "\n" + Html.fromHtml("<b>Date: </b>") + strDate + "\n" + Html.fromHtml("<b>Post number: </b>") + day_con + "\n\n" + text;
            }
            userEntryDay1.put(t, newEntryText);
            rootRef.child(fullpath).updateChildren(userEntryDay1);
            //It saves the new counter value
            Map<String, Object> count1 = dataSnapshot.getValue(Map.class);
            count1.put("Counter", day_counter);
            crootRef.updateChildren(count1);
            messageDialog = new Dialog(getContext(), R.style.AlertDialog);
            messageDialog.requestWindowFeature(Window.FEATURE_NO_TITLE);
            messageDialog.setContentView(R.layout.custom_message);
            messageText = (TextView) messageDialog.findViewById(R.id.messageText);
            if (day_counter == 1) {
                messageText.setText("Congratulations " + nick + "\nyou entered the " + day_counter + " good event of the day!\nPlease enter 2 more. \n");
            } else if (day_counter == 2) {
                messageText.setText("Congratulations " + nick + "\nyou entered the " + day_counter + " good event of the day!\nPlease enter 1 more. \n");
            } else {
                messageText.setText("Congratulations " + nick + "\nyou entered the " + day_counter + " good event of the day! \n");
            }
            ImageView emotion = (ImageView) messageDialog.findViewById(R.id.emotion_image);
            emotion.setImageResource(R.drawable.hands);
            messageDialog.setCancelable(true);
            messageDialog.setCanceledOnTouchOutside(true);

            int width = 450px;
            int height = 300px;
            messageDialog.getWindow().setLayout(width, height);
            messageDialog.getWindow().setGravity(Gravity.CENTER);
            messageDialog.getWindow().setBackgroundDrawable(new ColorDrawable(Color.TRANSPARENT));
            messageDialog.show();
        }
    });
    @Override
    public void onCancelled(FirebaseError firebaseError) {
    }
}
// End 1. Read Counter and add 1
//Start Read Current Date and Time
Calendar c = Calendar.getInstance();
SimpleDateFormat sdf = new SimpleDateFormat("dd:MM:yyyy HH:mm:ss a");
strDate = sdf.format(c.getTime());
//End Read Current Date and Time

```

### ***Frag\_Exercise\_1\_Read\_Others\_Firebase\_Tab1 Fragment***

This fragment reads all entries that have been entered during the first day and presents them in a *Listview* in case they are marked as shared.

```

if (day1) {
    rootRef_day_1.addListenerForSingleValueEvent(new ValueEventListener() {
        @Override
        public void onDataChange(DataSnapshot dataSnapshot) {
            listItems_day_1.clear();
            for (DataSnapshot childd : dataSnapshot.getChildren()) {
                Boolean count = childd.child("Counter").exists();
                if (count) {
                    HashMap<String, Object> users = (HashMap<String, Object>) dataSnapshot.getValue();
                    String counter = (String) childd.child("Counter").getValue().toString();
                    curentCounterValue = Integer.valueOf(counter);
                    maxCount = curentCounterValue;
                    if (childd.getKey().equals("Counter"))
                        continue;
                    String name = (String) childd.getValue().toString();
                    if (getActivity() != null) {
                        adapter_day_1 = new ArrayAdapter<String>(getContext(),
                            R.layout.custom_textview,
                            listItems_day_1);
                    }
                    for (int x = 1; x <= maxCount; x++) {
                        String xc = String.valueOf(x);
                        String postnum = "Post" + xc;
                        String post = (String) childd.child(postnum).getValue().toString();
                        if (post.startsWith("Shared")) {
                            ex1ListView.setAdapter(adapter_day_1);
                            String arr[] = post.split("\n", 2);
                            String postnoshare = arr[1];
                            listItems_day_1.add(postnoshare);
                            adapter_day_1.notifyDataSetChanged();
                        }
                    }
                } else {
                    listItems_day_1.clear();
                    if (getActivity() != null) {
                        adapter_day_1 = new ArrayAdapter<String>(getContext(),
                            R.layout.custom_textview,
                            listItems_day_1);
                    }
                    ex1ListView.setAdapter(adapter_day_1);
                    String postnoshare = "There are no shared entries for this day.";
                    listItems_day_1.add(postnoshare);
                    adapter_day_1.notifyDataSetChanged();
                }
            }
        }
        @Override
        public void onCancelled(FirebaseError firebaseError) {
        }
    });
} else {
    listItems_day_1.clear();
    if (getActivity() != null) {
        adapter_day_1 = new ArrayAdapter<String>(getContext(),
            R.layout.custom_textview,
            listItems_day_1);
    }
    ex1ListView.setAdapter(adapter_day_1);
    String postnoshare = "There are no shared entries for this day.";
    listItems_day_1.add(postnoshare);
    adapter_day_1.notifyDataSetChanged();
}

```