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POCKET PSYCHIATRY FOR MILLENNIALS – FRIEND OR FOE?

A SYSTEMATIC REVIEW OF EXISTING SELF-COMPASSION APPS

MASTERTHESIS (10 EC)

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ABSTRACT

BACKGROUND: Millennials, the generation of individuals born between 1985 and the early 2000, experience high degrees of pressure and self-criticism, often resulting in an increase of mental health problems. The practice of self-compassion, a concept consisting of the three elements self-kindness, common humanity and mindfulness, has proven to be effective as a protective factor against psychopathology and as a buffer against negative life events. Self-compassion can be viewed as compassion directed towards your inner self. The practice of self-compassion can also be taught via mobile phones by Mental Health apps. However, most health apps that are currently available, lack scientific evidence and scientific evaluations regarding their development and their quality. **STUDY PURPOSE AND METHODS**: The primary purpose of this systematic review is to evaluate the quality of current self-compassion apps. Apps were searched in the iTunes Store. After the selection process, eight apps were included for further evaluation. First, the apps were analyzed by checking the presence of an *underlying theoretical framework* and of *evidence based exercises*. This was achieved by searching for references to self-compassion theories and by comparing the apps' exercises with those incorporated in self-compassion interventions. Afterwards, the persuasive technology systems design model (PSD) was used to check the presence of *persuasive technology elements*, that stimulate the use of an intervention. Finally, the mobile rating scale uMARS was applied to provide a systematic and comparable rating of the overall quality. **RESULTS:** None of the apps referred to a theoretical self-compassion framework. All apps used exercises found in evidence based self-compassion interventions. Concerning the use of persuasive technology elements, all apps made use of Primary Task Support features. Credibility Support was used in five apps. Dialogue Support and Social Support were applied in two apps. The uMARS rating scale revealed, that the functionality and appearance of the apps reached higher ratings compared to those concerning the degree of user engagement and the presented information within the apps. **CONCLUSION**: This study concludes, that the evaluated self-compassion apps are evidence based due to the incorporated exercises, but they lack references to used theories. This missing information makes them appear less trustworthy. Furthermore, persuasive system design elements are poorly implemented. Future app development should consider the found limitations to achieve higher persuasiveness. Additionally, the uMARS rating scale appears to be a timesaving evaluation tool, which reflects all the results of this study in just one rating scale. It is therefore recommended for future Mental Health apps evaluation studies. Based on the comparison of the apps, the MindSpace app could be identified as the highest scoring app, therefore representing a recommendation to be used by millennials.

Contents

Introduction

Millennials, the generation of individuals born between 1985 and the early 2000s, represent todays individuals ranging from 17 to 32 years. They are described as high-achieving rule followers with a high experienced pressure to succeed and with high degrees of self-criticism, accompanied by an increase of mental health problems (Watkins, Hunt, & Eisenber, 2011). As these risk factors illustrate, successful navigation through this vulnerable period and protective factors against psychopathology are needed.

A consistent finding in literature confirms the practice of self-compassion as such a protective factor against psychopathology (Neff, 2009, Neff et al. 2007) and as a buffer against negative life events (Leary et al, 2007). Self-compassion entails three main components: *self-kindness*, *common humanity* and *mindfulness* (Neff, 2009). Together, they can be viewed as compassion directed inwards the self.

According to the World Health Organization (WHO, 2016), there is a wide gap between the need for treatment and its provision all over the world. The question arises how to reach the millennials at possible risk, when professional psychological help services are not even capable of providing the individuals with mental disorders with the needed treatment? Modern day technology has provided a solution, able to reach especially adolescents worldwide and diminish the aforementioned gap: *mobile health apps.* Mobile health apps are health interventions that are offered via mobile phones. These portable health apps have the potential to reach a large number of people worldwide. At the end of 2012, 4.3 billion unique mobile users were counted (Donker et al., 2013). Research suggests that mobile methods are

particularly preferred by adolescents (Price, 2014), making it an ideal medium to reach this population. Current research demonstrates that mental health apps have proven effect sizes comparable to forms of traditional psychotherapy (Leigh, & Flatt, 2015).

However, most health apps that are currently available, lack scientific evidence and scientific evaluations regarding their development and their quality (Leigh, & Flatt, 2015). It is therefore necessary to identify and distinguish those apps, from apps that are built upon scientific findings as they become more largely available for the broad public. This systematic review evaluates the quality of current self-compassion mental health apps developed to improve well-being for millennials.

Theoretical framework of Self-Compassion

Psychology, since World War II, has been largely focusing on dysfunctions, illnesses and the reduction of those malfunctioning traits to an assumed "normal" baseline of functioning. In the early 2000s, Seligman and Csikszentmihalyi introduced a more holistic approach, the positive psychology. Complementary to the traditional psychology, the positive psychology reinterprets well-being not only as the absence of psychopathology but also considers human strengths and potentials (Seligman and Csikszentmihalyi, 2000). Therefore, the positive psychology not only focuses on the reduction of malfunction but also on the improvement of well-being of individuals. The practice of self-compassion is one of those important human strengths, gaining more and more popularity.

Self-compassion entails three main components: *self-kindness*, *common humanity* and *mindfulness* (Neff, 2009). Together, they can be viewed as compassion directed inwards the self. *Self-kindness* covers the ability to treat oneself with care and understanding instead of being harshly self-critical and judgmental. *Common humanity* describes the recognition of imperfections as a shared aspect of all humans. Failures should not resemble a reason to feel isolated, they are seen as common in the human condition. Being mindful involves being non-judgmental toward the present moment and experienced feelings rather than exaggerating the negative impact of one's suffering. Teaching these skills to millennials struggling with questions such as "What do other people think of me?", "Am I as good as the others?" and facing mental as well as physical stress about academic performances, can alleviate the experienced levels of stress and buffer against future psychopathology. Not passing an exam for example, would no longer resemble a reason to feel failed as a person or to feel isolated. It would be recognized as a shared imperfection that merely happens from time to time.

Exercises that are commonly incorporated in self-compassion interventions, address the three components. The compassionate body scan for example, helps to pay compassionate and loving attention to each body part, while gently breathing and letting every sensation being as it is. This exercise practices the ability to understand, to be fully aware and non-judgmental toward the own body, thereby resembling the components mindfulness and self-kindness. The sense and savor walk instructs the practitioner to notice as many pleasurable things as possible while taking a walk, slowly, one after another and with the use of all senses.

Benefits of practicing self-compassion

When reviewing existing self-compassion interventions, a consistent finding is that self-compassion acts as a protective factor against psychopathology (Neff, 2009; Neff et al. 2007) and as a buffer against negative life events (Leary et al, 2007). Therapeutic interventions such as the Mindful Self-Compassion workshop (Neff, & Germer, 2013) are aimed to improve the three components of self-compassion. MSC is an 8-week workshop designed to train people to be more self-compassionate and to increase their well-being. A pilot study conducted by Neff and Germer (2013) on a non-clinical population, with individuals belonging to the group of millennials, showed that MSC is effective in increasing self-compassion, mindfulness, compassion for others as well as other aspects of well-being and decreased levels of stress, lasting at least 1 year after completion.

The practice of self-compassion is associated with the activation of innate soothing and self-regulation functions, which may help to balance out an overactive threat system (Gilbert, 2013). The threat system is for example activated when millennials face scholar or academic performance pressure and experience the feeling of being permanently competing with other students or scholars. The permanent activation of the threat system can lead to the chronic experience of stress, resulting in psychopathological symptoms (Gilbert, 2013). Low levels of self-compassion are in fact associated with higher levels of anxiety, depression, shame, rumination and perfectionism (Barnard and Curry, 2011). By practicing self-compassion, these feelings of permanent competition and the pathological need of being perfect can be reduced. In fact, the practice of self-compassion reduces stress levels, decreases self-reported depression symptoms, anxiety, shame and the intrusiveness of self-critical thoughts (Neff, & Germer, 2013; Neff et al., 2007). Furthermore, it is associated with decreases of psychoticism and paranoia under patients suffering from schizophrenia (Gilbert, & Irons, 2004). Additionally, studies have found associations between self-compassion and happiness, optimism, wisdom, curiosity and exploration, personal initiative, and emotional intelligence (Heffernan, Griffin,

McNulty, & Fitzpatrick, 2010; Hollis-Walker & Colosimo, 2011; Neff, Rude, & Kirkpatrick, 2007).

In conclusion, the practice of self-compassion is an important skill for millennials to develop, able to increase psychological qualities on the one hand and to decrease stress and act as a protective factor against the development of psychopathology on the other.

mHealth: pocket psychiatry & persuasive technology

Many of today's well-being improving interventions are offered as *apps* and can be downloaded via services like the iTunes store or the Google Play store, making them especially attractive for adolescents and students. The latest number of accessible smartphone apps designed for healthcare is approximately 165,000 (Armontrout, Torous, Fisher, Drogin & Gutheil, 2016). A review on two apps conducted by Donker (2013) gave first insights in possible advantages. They reported that *adherence* rates, the degree in which tasks are executed and completed as intended by the designer (REF), were higher when compared to adherence rates seen with internet-based interventions. This is associated with accompanied advantages of the mobile delivery mode such as the portability and flexibility, but also to the expanded communication functionalities of mobile devices such as microphones, cameras, accelerometers and Bluetooth or global positioning sensors (Price, 2014). Furthermore, research has shown that a number of mHealth apps have been effective in treating depression, stress, anxiety and smoking cessation (Donker et al., 2013, Price, 2014).

Due to the rapidly growing number of free accessible apps, empirical research has not yet caught up with the overabundance of available apps. Most app-based treatments are characterized by numerous shortfalls, such as a lack of an underlying evidence base and emerging questions concerning their clinical utility, cost- effectiveness, privacy and safety (Donker et al., 2013; Leigh, & Flatt, 2015). This illustrates one of today's contemporary challenges, the need to understand the risks and to evaluate existing apps as they become more largely available for the broad public.

Beyond that, it is also necessary to consider the usability of apps during app development in order to promote a continuous use (Price, 2014, Gemert-Pijnen, Peters, & Ossebaard, 2013). If the content of apps is evidence-based, there is still the user's subjective perception of the app that may limit engagement and completion of tasks. This will be the case, when the use of the app is challenging due to poor or complex design. Considering the usability of an app includes the evaluation of app components that could prevent task completion, could create frustration or confusion and consequently, lead to low adherence rates (Price, 2014).

Persuasive technology

Persuasive technology can be described as „strategies or techniques to influence people's attitude, behaviors and rituals through technologies like computers or mobile devices (Gemert-Pijnen, Peters, & Ossebaard, 2013). This can be achieved by making use of persuasive system features, such as reminders. Reminders stimulate and motivate the user to log in more often and to complete his/her task.

Persuasive Systems Design Model

Oinas-Kukkonen (2009) presented a behavior change support system aimed at influencing attitudes, behavior and compliance, without using deception. In the *Persuasive Systems Design* model (PSD; Oinas-Kukkonen, & Harjumaa, 2009), build in features of the technology can have four supporting roles. The four supporting roles are *Primary task support, Dialogue Support, Social Support and Credibility Support.* Together, they help the user in reaching his or her aim (Primary Task Support). They support the interaction between the user and the system (Dialogue Support). Moreover, they establish the credibility of the system (Credibility Support) and they provide principles such as stimulating the users to, for example, give each other feedback to learn or help the others in reaching their aims (Social Support). Principles belonging to each supporting role, are presented with a detailed description in Appendix C.

A systematic review of existing web based interventions investigated the presence of persuasive system features and demonstrated that primary task support was used most often (Kelders, Kok, Ossebaard, & Gemert-Pijnen, 2012). This was especially the case for *tunneling* and *tailoring* to the user's profile within the intervention. Dialogue support was shown to be a significant predictor for adherence, especially reminders and the use of praising the user for logging in or completing tasks. Nonetheless, it was less often incorporated within interventions than primary task support. Social support was rarely used. In general, studies have shown that the more an intervention uses persuasive technology, the more are users involved (Kelders, Kok, Ossebaard, & Gemert-Pijnen, 2012).

Purpose of the study

The practice of self-compassion has proven to be effective as a protective factor against psychopathology and as a buffer against negative life events. The practice of self-compassion can be taught via mobile phones by Mental Health apps. As current issues illustrate, most mental health apps that are currently available, lack scientific evidence and scientific evaluations regarding their development and their quality. Therefore, the primary purpose of

this systematic review is to evaluate the quality of current self-compassion apps, that can be found in the iTunes Store and are targeted at improving well-being via the practice of self-compassion. As pointed out, it is necessary to consider the apps usability, thus, to identify app components that could prevent task completion or could create frustration and prevent the user from a continuous use. Furthermore, behavior change support systems were developed, that are aimed at influencing attitudes, behavior and compliance without using deception. The quality of an app is furthermore determined, by whether it reaches its full potential by implementing such persuasive technology elements. The main research questions will analyze the quality of apps by 1) checking for the presence of an *underlying theoretical framework*, 2) checking for the *presence of evidence based exercises* and 3) checking for the incorporation of *persuasive technology elements*. Furthermore, the apps will be rated using the uMARS (Stoyanov, Hides, Kavanagh, & Wilson, 2016), a mobile application rating scale, to provide a systematic and comparable subjective end-user rating of the overall quality of the selected apps.

Method

A systematic review of free accessible self-compassion apps was conducted using the iTunes Store as database. The iTunes Store is a multimedia platform that can be reached for owners of Apple products, such as iPhones or iPads. Among other services, it offers apps that can be downloaded and used with the owned product. The apps were downloaded and tested on an iPhone 5 during a period of two weeks.

After the selection process, apps were evaluated regarding the presence of theoretical based frameworks and the use of evidence based exercises. Furthermore, apps were coded using the PSD-Model (Oinas-Kukkonen, H, 2009). Additionally, the uMARS was used to evaluate the user's subjective perception of the app's usability.

App selection

The app selection was conducted in November 2016 using an iPhone 5 (iOS 10.1.1). The iTunes Store offers a simple but limited search function. The search function does not encompass additional search filters. The combination of the keywords "self-compassion" and "adolescents", "self-compassion" and "prolonged adolescents" or "millennials" resulted in zero hits. The search of the keyword "self-compassion" resulted in eight apps. Searching for the keyword "compassion" alone resulted in 96 hits. The eight hits from the search of the keyword "self-compassion" were also found in the search of the keyword "compassion". Resulting from

these overlapping findings, the hits of the "compassion" search were used for further examination. Screenshots of the search can be reviewed in Appendix A.

In- and exclusion criteria

The inclusion criteria were defined as apps incorporating exercises aimed at improving self-compassion and/ or providing psychoeducational information. Apps were screened reading the name of the app, the description of the app and afterwards, downloaded if meeting the criteria. Based on the assumption that adolescents would rather use cost-free apps than to pay for them, only cost-free apps were included. Consistent with the aforementioned inclusion criteria, apps that are solely aimed at improving mindfulness were excluded. It is important to distinguish between interventions targeting all three components of self-compassion and interventions aimed at improve a single component. Research has shown, that improving self-compassion by affecting all three components within an intervention, is a better predictor for well-being than improving mindfulness alone (Van Dam, Sheppard, Forsyth, & Earleywine, 2011). As such, apps based on therapeutic interventions as the Mindfulness Based –stress reduction (MBSR; Shapiro, 2005) were excluded, because they only target the improvement of the single component *mindfulness*.

19 apps were excluded due to accompanied costs of use. A total of 56 apps were excluded, that were not aimed at improving self-compassion and neither provided psychoeducational information (e.g. religious apps, n = 20; donation apps, n=12). Additionally, apps were excluded that were not written in English, German, Italian or Dutch (n=11). After this first screening stage, 9 apps were selected and downloaded for further examination. During the evaluation, an additional app was excluded due to malfunctioning. Finally, eight apps were included for the evaluation.

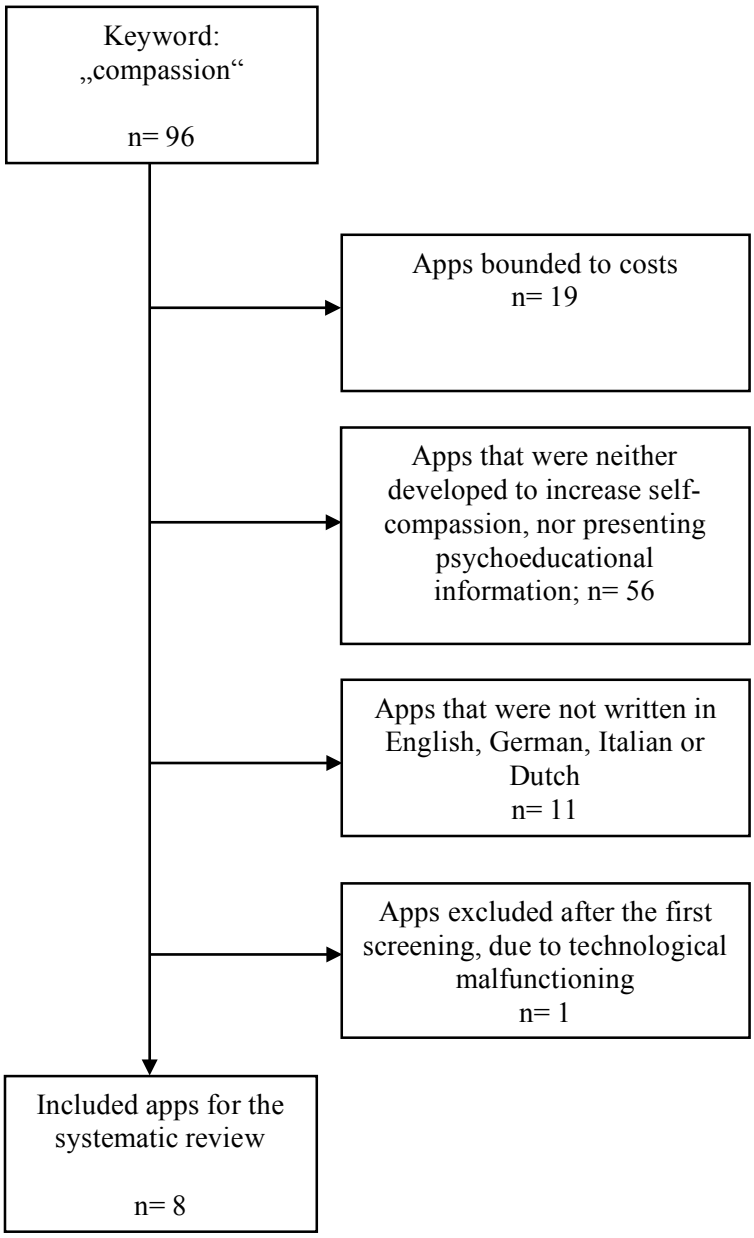


Figure 1: Flowchart of inclusion and exclusion criteria for the selection of apps

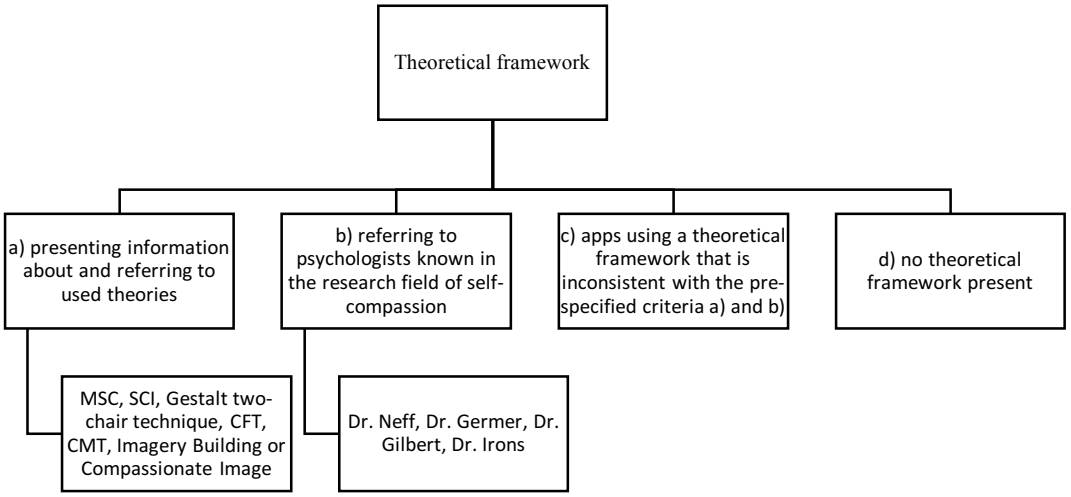
App Evaluation

Assessment of theoretical framework

First, the presence of an underlying theoretical framework was checked for. This was done by checking for statements regarding the use of a self-compassion theory. These statements were searched within the description of an app in the iTunes store, within the build-in information and within the description and instruction of the incorporated exercises. To indicate whether apps were based on theoretical frameworks that can be found in literature, a labeling system was used. Apps were labeled as a) presenting information about and referring to used theories,

b) referring to psychologists known in the research field of self-compassion, c) apps using a theoretical framework that is inconsistent with the pre-specified criteria a) and b), or d) when no theoretical framework was present at all.

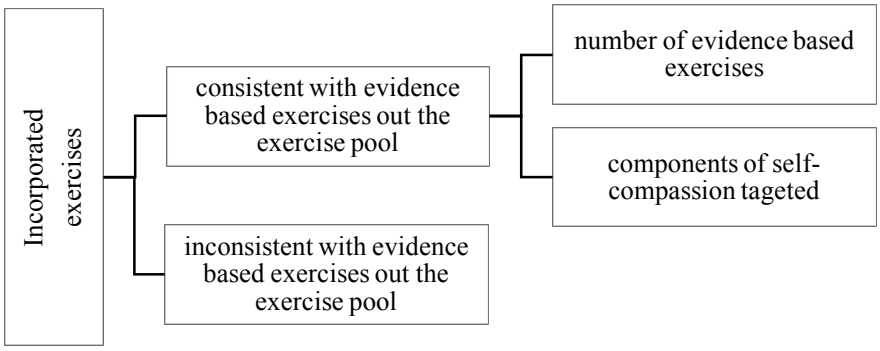
Figure 2: Labeling with incorporated scoring system of apps theoretical framework



Assessment of incorporated exercises

In order to check the evidence-based character of the incorporated exercises, they were compared with those proven to be effective. All existing and accessible exercises of existing interventions as the MSC workshop or the CFT were collected and put into a pool of exercises. While following the instruction of each incorporated exercise within the eight apps, the exercises were compared with the instructions of exercises within the self-compassion exercise pool. The exercise pool can be found in Appendix B. Furthermore, exercises were subcategorized by the component of self-compassion that was aimed to improve. This was done by reading the instructions and interpreting whether they were aimed to improve self-kindness, common humanity or mindfulness. Figure 3 provides an overview of the specifications.

Figure 3: Specification framework of incorporated exercises



Assessment of the use of Persuasive Technology

The evaluation of the incorporation of persuasive technology elements within apps was based upon the persuasive technology systems design model (PSD; Oinas-Kukkonen, & Harjumaa, 2009). Each app was tested and evaluated using the four elements (Table 1). Every single app was evaluated by checking the presence of each principle. Abbreviations were added in brackets for further use throughout this review. A detailed description and examples of the design appendix is added in Appendix C.

Table 1: Persuasive Systems Design Model (Oinas-Kukkonen, & Harjumaa, 2009)

Primary Task Support	**Dialogue Support**	**Credibility Support**	**Social Support**
• Reduction (Rd) • Tunneling (Tu) • Tailoring (Ta) • Personalization (P) • Self-monitoring (Sm) • Simulation (S) • Rehearsal (Rh)	• Praise (Pr) • Rewards (Rw) • Reminders (Re) • Suggestion (Sg) • Similarity (Si) • Liking (L) • Social Role (Sr)	• Trustworthiness (Tw) • Expertise (E) • Surface credibility (Sc) • Real-World feel (Rwf) • Authority (A) • Third-party endorsement (Tpe) • Verifiability (V)	• Social learning (Sl) • Social comparison (SC) • Normative Influence (Ni) • Social facilitation (Sf) • Cooperation (Co) • Competition (Com) • Recognition (R)

Assessment of the end user's subjective perception of the app

A mobile application rating scale was filled in by the author to provide a systematic and comparable rating of the overall quality of the selected apps. The uMARS (Stoyanov, Hides,

Kavanagh, & Wilson, 2016) is a reliable end-user mobile application rating scale, which assesses the quality of mental health apps. It was developed in response to the issues regarding the quality, efficacy and security of the increasing amount of health apps and has good psychometric qualities with a reported internal consistency of alpha= .90 and a good test-retest reliability (Stoyanov et al., 2016). The uMARS consists of 20 items and 6 subscales – *engagement*, *functionality*, *aesthetics*, *information quality*, *subjective quality* and *perceived impact* (Stoyanov et al., 2016). The mean score of the first four subscales is summed and divided by four to obtain the app quality mean score. Depending on the intended use, the last two subscales can be added to the summation. In this review they were excluded as they did not deliver additional information of interest, that could be used. The uMars rating scale and description are added in Appendix D. The rating scale embraces statements about the quality within each subscale that have to be answered in terms of accuracy on a 5-point scale from 1 '*inadequate'* to 5 '*excellent'*. The subscale *engagement* consists of the items entertainment, interest, customization, interactivity and target group. The subscale *functionality* targets the performance of apps features, ease of use, navigation and gestural design. The subscale aesthetics rates the attractiveness and design of an app. The subscale *information* refers to the quality of information, the quantity of information, the correct provision of visual information and the credibility of the source.

Results

Selected Apps

Table 2 provides a short description of the apps found in the iTunes Store and the update date. For users willing to pay upgrade costs, three apps also offered an upgrade including more practices and features. Within this review, the upgrade was not made and the free versions of those apps were used. Although *MindSpace* and *Meditation and Me* were developed by the same producer, it had a different set up and were therefore analyzed separately.

Table 2: Overview of included self-compassion apps

App Name	Exercise Label	Last Update
Compassion Today	A portal to 3D compassion – caring for others, self and the earth. Providing access points to a variety of compassion resources and exercises.	13.05.2015
Self-Compassion Photo Meditation ***free version**	This app supports compassion for yourself and other through structuring meditations using photos from your iPhone or iPad	28.08.2015
Learn Meditation: Calm Down	Basic meditation techniques and subsequent walking meditation, mindfulness meditation and compassion meditation. Aimed to reduce stress and anxiety ; increase happiness and inner peace.	09.12.2016
Less Stress Compassion	On-the-go compassion exercises to help in dealing with stress. Part of an ongoing West Virginia University study.	01.09.2015
Meditation and Me ***free version**	Platform for guided meditations teaching mindfulness and compassion. Guided by Dr. Joe Flanders, Dr. Paul Gilbert and Dr. Kristin Neff	18.10.2016
Self-Compassion Posing	A two one minute self-compassion posing practice to enhance your daily well-being. Developed and powered by Marcos Cajina Heinzkill.	13.05.2015
Shambhala ***free version**	Cultivate a healthy meditation habit. Incorporates guided meditation exercises by trusted teachers in the Shambhala meditation. Inspire compassionate, sustainable and just human societies.	06.07.2016
MindSpace	Guided Meditation from our clinic. Also designed to determine what kind of meditation works best for you. Designed with the help of professional psychologists	05.04.2016

Theoretical Framework

Table 3 shows the results regarding the theoretical frameworks found within the apps. None of the apps presented information or referred to theories consistent to the literature findings on self-compassion. Just three apps made references to psychologists known in the research field. Four out of the eight apps provided psycho-educational information without referring to any source. Among those four apps, one app provided psychoeducational information but referred to a theory that was not consistent with the literature findings on self-compassion. One out of eight apps, presented no theoretical or psychoeducational information at all.

Table 3: Evaluation on theoretical framework of the selected self-compassion apps

App Name	Theoretical framework	Label
MindSpace	Guided by Dr. Joe Flanders, Dr. Paul Gilbert and Dr. Kristin Neff	b
Meditation and Me	Guided by Dr. Joe Flanders, Dr. Paul Gilbert and Dr. Kristin Neff	b
Compassion Today	Guided by Dr. Christopher Germer and Dr. Kristin Neff	b
Learn Meditation: Calm down	Provides psycho-educational information within exercises without references	c
Self-Compassion Posing	Provides psycho-educational information within exercises without references	c
Less Stress Compassion	Provides psycho-educational information within exercises without references	c
Shambhala	Based on findings from Tibetan Shambhala Meditation	c
Self-Compassion Photo Meditation	No information	d

Incorporated exercises

Table 4 presents the results of the evaluation of the incorporated exercises. Seven out of eight apps included at least one evidence-based exercise. The Shambhala meditation app is the only app that incorporated exercises inconsistent with the pre-specified pool of self-compassion exercises. The apps Self-Compassion Photo Meditation and Self-Compassion Posing, incorporate only a single exercise. This exercise is called loving kindness meditation and is aimed at improving self-compassion by repeating expressions regarding wishes of well-being

for others and for oneself. The Shambhala app provided other meditation exercises and was based on Tibetan meditation principles. The seven apps differ substantially in the number of incorporated exercises, ranging from one to 21 exercises. Five out of the seven apps cover the improvement of all three self-compassion components. Common humanity was targeted by implementing a loving-kindness meditation. This means, that it covers the improvement of all three components of self-compassion with a single exercise. The apps Self-Compassion Photo Meditation and Self-Compassion Posing, also used a loving kindness meditation exercise.

Table 4: Evaluation of incorporated exercises

App Name	Exercise Label	Self-compassion components covered			N of consistent exercises
	1= consistent 0= in-consistent	Self-kindness	Common Humanity	Mindfulness	
Compassion Today	1	x	x*	x	21
Self-Compassion Photo Meditation	1	x	x*	x	1
Learn Meditation: Calm Down	1	x	x*	x	3
Less Stress Compassion	1	x	x*	x	3
Meditation and Me	1	x	x*	x	4
Self-Compassion Posing	1	x	x*	x	1
Shambhala	0				0
MindSpace	1	x	x*	x	3

** Covered by a loving kindness meditation exercise, that improves all three components of self-compassion.*

Persuasive Technology Systems Design

Table 5 provides an overview of all persuasive technology elements found in the selected apps. With a total score of 12 persuasive technology elements used, the MindSpace app reached the maximum score in comparison with all other apps. The Compassion Today app used the second most elements. Self-Compassion Photo Meditation used only four elements, thereby representing the app with the minimum score of used elements. All eight apps made use of Primary Task Support. With an average use of 3.6 elements per app, primary task support

represents the category with the most elements applied within the apps. Credibility Support was used in five out of eight apps. Dialogue Support and Social Support were not only applied in just two apps, but also with the lowest number of applied elements per app.

Table 5: incorporated persuasive technology features within the self-compassion apps

Apps	Primary task support	Dialogue support	Credibility support	Social support	Total
Compassion Today	2	-	4	4	10
Self-Compassion Photo Meditation	3	-	-	1	4
Learn Meditation: Calm down	4	2	-	-	6
Less Stress Compassion	4	-	2	-	5
Meditation and Me	4	-	4	-	8
Self-Compassion Posing	4	2	-	-	6
Shambhala	3	-	4	1	8
Mindspace	6	2	4	-	12
Use on average	3.6	0.75	1.75	0.75	

Primary Task Support

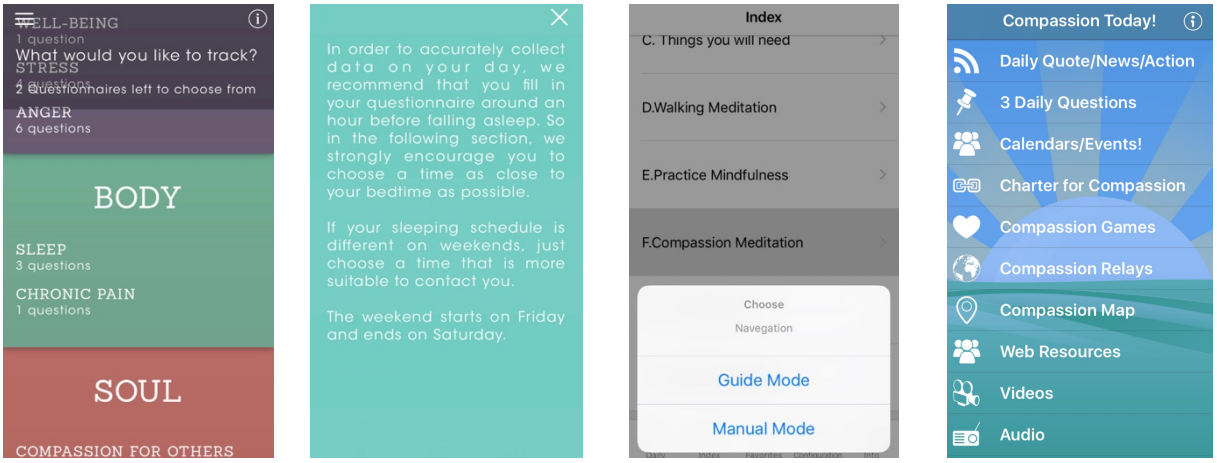
Primary Task Support elements (see Table 6 below) were used in all eight apps, especially *rehearsal* (Rh), *reduction* (R) and *personalization* (P). Reduction was provided by presenting the exercises clearly arranged. Personalization refers to the option to customize own meditation session including the duration, a range of mediation bells to choose from and the option to set a time at which to be reminded to meditate. The self-monitoring principle was applied to only three apps. Figure 4 depicts some examples. One app differed from all other apps in terms of personalization and tailoring. In the beginning, the *MindSpace* app asked the user questions regarding the present problematic of the user, hereby applying the *tunneling* principle, and additionally *tailoring* the meditation program based on the given answers. It is programmed to

save these settings and collect further data to determine which kind of meditation works best for the user. The apps *Learn Meditation: Calm Down* and *Self-Compassion Posing* also made use of tunneling. This was optionally applied when the user decides to follow the exercises in a guided manner instead of manually. The app *Compassion Today* made use of the tailoring principle, by providing a variety of self-compassion platforms, such as websites, videos, podcast etc. The app is therefore tailored to the user interested in self-compassion in general.

Table 6: Primary Task Support Elements in each app

Apps	Reduction	Tunneling	Tailoring	Personalization	Self-Monitoring	Simulation	Rehearsal
Compassion Today	-	-	X	-	-	-	X
Self-Compassion Photo Meditation	X	-	-	X	-	-	X
Learn Meditation: Calm down	X	X	-	X	-	-	X
Less Stress Compassion	X	-	-	X	-	-	X
Meditation and Me	X	-	-	X	X	-	X
Self-Compassion Posing	X	X	-	-	X	-	X
Shambhala	X	-	-	X	-	-	X
Mindspace	X	X	X	X	X	X	X
Total	7	3	2	6	3	1	8

Figure 4: Personalization, tailoring and tunneling examples



First two screenshots on the left illustrate the personalization and tunneling examples of the MindSpace app. The third screenshot represents the optional tunneling of the Learn Meditation: Calm Down app. The fourth screenshot depicts the broad range of the provided self-compassion platform of the Compassion Today app.

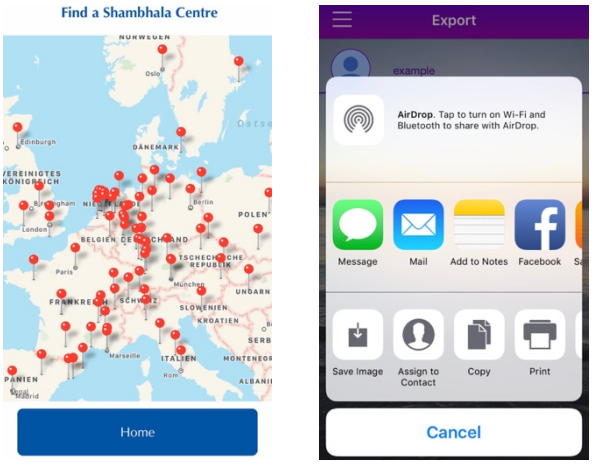
Social Support

Social Support was along with Dialogue Support the least used. In total, only three apps incorporated principles deriving from these categories (see Table 7 below). *Compassion Today* was the only app, which made use of four Social Support principles. This was accomplished by connecting the app to external networks, sharing experiences, participating in self-compassion games and signing in for a self-compassion company (see Figure 5 below). The other two apps using Social Support were the *Shambhala* app and the *Self-Compassion Photo Meditation* app. The Shambhala app applied the social facilitation principle by providing the localization of Shambhala Meditation centers nearby. The Self-Compassion Photo Meditation app applied this principle by providing the means to share the accomplishments within the tasks on Facebook.

Table 7: Social Support Elements in each app

Apps	Social Learning	Social Comparison	Normative Influence	Social Facilitation	Cooperation	Competition	Recognition
Compassion Today	X	-	-	X	X	X	-
Self-Compassion Photo Meditation	-	-	-	X	-	-	-
Learn Meditation: Calm down	-	-	-	-	-	-	-
Less Stress Compassion	-	-	-	-	-	-	-
Meditation and Me	-	-	-	-	-	-	-
Self-Compassion Posing	-	-	-	-	-	-	-
Shambhala	-	-	-	X	-	-	-
Mindspace	-	-	-	-	-	-	-
Total	1	0	0	3	1	1	0

Figure 4: Social facilitation examples in the Shambhala and Self-Compassion Photo meditation apps.



Screenshot of the Shambhala centers nearby on the left. Sharing options of the Self-Compassion Photo Meditation app on the right.

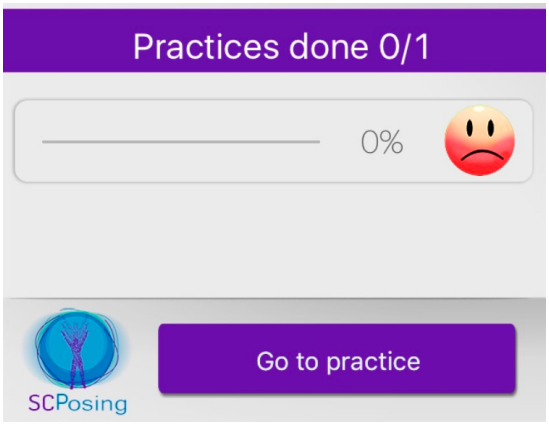
Dialogue Support

Among the three apps making use of Dialogue Support, three applied the suggestion principle by suggesting how often to practice (Table 8). Two other apps incorporated reminders and only the *Self-Compassion Posing* praised the users for completing tasks. Self-Compassion Posing includes also a combined suggestion of one practice per day within the praise (see Figure 5 below).

Table 8: Dialogue Support Elements in each app

Apps	Praise	Rewards	Reminders	Suggestion	Similarity	Liking	Social Role
Compassion Today	-	-	-	-	-	-	-
Self-Compassion Photo Meditation	-	-	-	-	-	-	-
Learn Meditation: Calm down	-	-	X	X	-	-	-
Less Stress Compassion	-	-	-	-	-	-	-
Meditation and Me	-	-	-	-	-	-	-
Self-Compassion Posing	X	-	-	X	-	-	-
Shambhala	-	-	-	-	-	-	-
Mindspace	-	-	X	X	-	-	-
Total	1	0	2	3	0	0	0

Figure 5: Suggestion and Praising example in the Self-Compassion Posing app



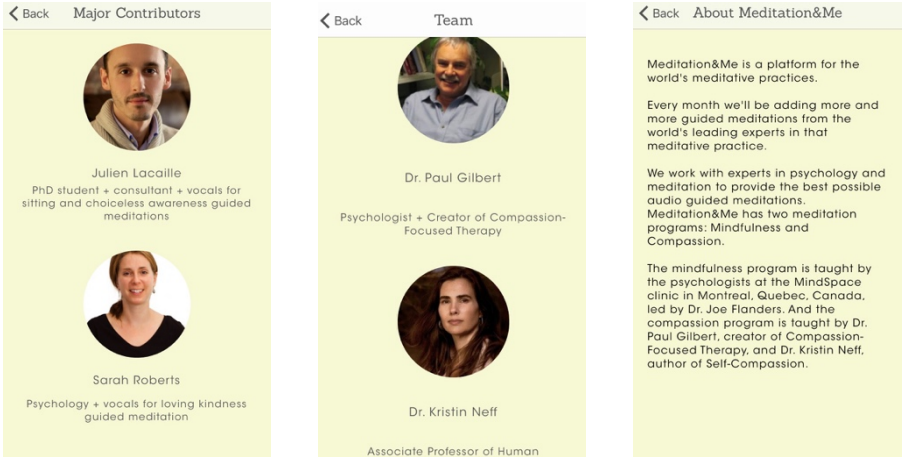
Credibility Support

Five of the eight apps applied Credibility Support (see Table 9 below). This was accomplished by making the information on the app appear trustworthy. Four out of these five apps also provided the user with references to look up, therefore applying the verification principle. Four apps additionally provided information about the experts that collaborated in the design or that even guided the incorporated exercises, thereby presenting the expertise principle and making the app trustworthy. The MindSpace app and the Mediation and Me app additionally presented the team that developed the app, thereby providing a real-world feeling. Screenshots below are added to exemplify the trustworthy set-up of the Meditation and Me app. The apps *Shambhala* and *Compassion Today* accomplished this by the already mentioned presentation of nearby compassion institutes or events on a map (Figure 6).

Table 9: Credibility Support Elements in each app

Apps	Trustworthiness	Expertise	Surface Credibility	Real-World Feel	Authority	Third- Party Endorsement	Verifiability
Compassion Today	X	X	-	X	-	-	X
Self-Compassion Photo Meditation	-	-	-	-	-	-	-
Learn Meditation: Calm down	-	-	-	-	-	-	-
Less Stress Compassion	X	X	-	-	-	-	-
Meditation and Me	X	X	-	X	-	-	X
Self-Compassion Posing	-	-	-	-	-	-	-
Shambhala	X	X	-	X	-	-	X
Mindspace	X	X	-	X	-	-	X
Total	5	5	0	3	0	0	4

Figure 6: Credibility support within the Meditation and Me app



uMars

The app quality mean scores provided by the user mobile app rating scale are presented in table 10. Comparing the total average score between each subcategory, reveals functionality and aesthetics as being the two subcategories with the highest scores. The subcategories engagement and information reached the lowest average scores among the four subcategories.

Table 10: uMars scores for the eight self-compassion apps

App Name	Engagement mean score	Functionality mean score	Aesthetics mean score	Information mean score	App quality mean score
Compassion Today	3.4	4	3.6	4	3.8
Self-Compassion Photo Meditation	2.6	4	3.6	3	3.3
Learn Meditation: Calm down	2.1	3	2.5	2.3	2.4
Less Stress Compassion	1.6	3.5	2.6	4	2.9
Meditation and Me	3	3.8	3.6	4	3.6
Self-Compassion Posing	2	4	3	0	2.3
Shambhala	3.4	3.5	3.3	3.3	3.3
Mindspace	5	4	5	4	4.5
Average	2.9	3.7	3.4	3.1	

The app that reached the highest mean score among the evaluated apps is the *MindSpace* app with a mean of 4,5 out of 5. It is followed with a large gap by the *Compassion Today* app with a mean score of 3,8. *Meditation and Me* reached a mean score of 3,7. The app *Self-Compassion Posing* was evaluated with the lowest mean score of 2,3. This can be explained by the missing mean score in the subcategory 'Information'. The app did not provide the user with any information and was rated with zero points in this subcategory. *Learn Meditation: Calm down* was also rated with a low mean score of 2,4. The app presented all the exercises in text format, its design had low quality and exercises were frequently interrupted by advertisement. The app *Less Stress Compassion* had also a relative low mean score of 2,9. It was not attractive in its design, provided only spoken information and the exercises had no name.

Subcategory: Engagement

The subscale *engagement* consists of the items entertainment, interest, customization, interactivity and target group. The engagement subcategory reports the lowest average of 2,9. The apps Less Stress Compassion and the Self-Compassion Posing, are examples of apps scoring lowest in the engagement subcategory. These apps do not allow any customization, are not entertaining and provide the minimum threshold of interest and interactivity. The Self-Compassion Posing app for example, uses a business-like suited man as instructor for the posing, thereby suggesting that the target group consists of business mans. In contrast, the app MindSpace offers a great range of entertainment by embodying interactivity and possibilities of customization, making the app interesting. It does so by asking the user questions about the given problems and by providing alternatives regarding which of the given problems he or she might be interested in improving.

Subcategory: Functionality

The functionality subcategory represents the subcategory with the highest average score (average= 3,7) among all subcategories. The subscale *functionality* represents the performance of app features, ease of use, navigation and gestural design. Apps within this subcategory do not differ substantially from each other. An exception is the Learn Meditation Calm down app, representing the app with the lowest score (functionality score=3). This can be explained by its complicated set-up, that takes time and effort to navigate through, which is additionally complicated by several advertisement apps interrupting this process.

Subcategory: Aesthetics

The subcategory aesthetics, covering the visual appeal of apps, reached the second highest average score (average= 3,4). Again, the app Learn Meditation: Calm Down reached the lowest scoring within this subcategory. Its complex set-up of the menu and the constantly interrupting advertisements are in presented with a low resolution. Furthermore, text passages extend the width of the phone's screen and the background pictures had low resolutions, thereby making a fluent and undisturbed comprehension of the presented text difficult. The app Less Stress Compassion reached the second lowest score because of its minimalistic two-colored design. Additionally, exercises were not even named but simply numerated. The MindSpace app in contrast, scored the maximum because of its vivid and comfortable colors, consistent symbols and overall representation of app elements.

Subcategory: Information

The subscale *information* refers to the quality of information, the quantity of information, the correct provision of visual information and the credibility of the source. The information section reached the second lowest average score of 3,1. The Self-Compassion posing app could not be

rated, because it did not provide any information at all. Due to already mentioned problems with the presentation and quality of information, the Learn Meditation: Calm Down app, scored the lowest possible score after the Self-compassion posing app.

Discussion

Apps' theoretical framework: used theories and incorporated exercises

The main research question of this systematic review is, whether current self-compassion apps are based on theoretical frameworks of self-compassion. First, references within the app were analyzed, which could indicate whether an app was based on a known self-compassion theory. None of the apps mentioned the use of a theory. Just three apps made references to known psychologists of the self-compassion research field. This first result is consistent with concerns in current literature regarding a lack of evidence based theoretical frameworks within mental health apps (Donker et al., 2013; Leigh, & Flatt, 2015).

Then, the incorporated exercises were compared with an evidence based pool of self-compassion exercises (see Appendix B). As the results illustrate, all the apps used at least one and even up to 21 evidence based exercises. The exercises covered the improvement of the two self-compassion components self-kindness and mindfulness. The component common humanity was not targeted independently, but by implementing the loving kindness meditation, which consists of a single exercise. The loving-kindness mediation has proven to improve all three components of self-compassion comprehensively (Boellinghaus, Jones, & Hutton, 2012). One single app did not meet the criteria, mainly because it was based on Tibetan meditation principles.

These results lead to the conclusion, that although the seven apps did not present sufficient indicators to clearly report that they are based on known self-compassion theories, they all incorporated evidence based exercises. The answer invokes the need for developers to present verifiable sources beneficial to promote credibility, a principle playing an important role within persuasive systems design (Oinas-Kukkonen, & Harjumaa, 2009).

Persuasive systems Design: do apps make use of persuasive elements?

The results showed that components of primary task support were used the most, followed by credibility support. Dialogue Support and Social support were rarely used. This result is in line with existing reviews of web based interventions (Kelders, Kok, Ossebaard, & Gemert-Pijnen, 2012). It is nevertheless a surprising finding, as mobile devices are accompanied by advantageous modalities, that can be fruitfully used to involve and support the user (Price,

2014). Rehearsal, a component of primary task support, was implemented in all eight apps and represents the most often used element. Reduction was interpreted as being implemented, if the steps needed to read the information and execute the task, were not complex and easy to find. This was the case in almost all apps, indicating that the cognitive effort needed is maintained on a minimum (Oinas-Kukkonen & Harjumaa, 2009). Personalization was found to be present in six out of eight apps. However, the implementation of this principle is rather poorly exhibited. The user was simply able to change the background picture or change the sound of a starting meditation bell. The other elements, such as tailoring and self-monitoring, which are simple to implement, by either developing the app with a target group in mind or by tracking the process, were surprisingly poorly implemented within the apps. Furthermore, dialogue support and social support were also poorly implemented within the apps. Seven out of the eight evaluated apps made no use of the availability of millions of blogs, forums, neither of chat rooms or other social connectivity features.

In conclusion, the evaluated apps did not or only poorly make use of the opportunities mobile devices offer in its modalities in terms of persuasive technology design, to ultimately avoid the problems of adherence, known to exist in previous web-based interventions (Kelders, Kok, Ossebaard, & Gemert-Pijnen, 2012).

uMars: the end user rating

The results of the uMARS scoring reflect and emphasize the previously discussed findings. The engagement and information subscales were found to be the sections with the lowest scores, indicating a common weak point of all evaluated apps. This means that apps are poorly entertaining, poorly capturing interest and do not target a pre-specified target group. In fact, the apps names, descriptions and build-ups revealed, that self-compassion apps were not especially targeting the specified target group of millennials selected for this review. One could assume that mobile health apps, in general, would be used more often by adolescents and students than by adults, as latter do not spend as much time on their mobile phones as the younger population (Hussein, Harun, Oon, 2016). However, for example, the self-compassion posing app used pictures of a business-like suited man as instructor for the posing practice. Thereby, it seems to target especially men of the working class, excluding female adolescents and students.

The low scores reached on the information subscale, mean that the apps perform poorly regarding the quality and quantity of information, the correct provision of visual information and the credibility of the source. Thereby, again underlying the need for developers to present verifiable sources.

In conclusion, the evaluated self-compassion apps share common weaknesses regarding the provision of information and regarding the degree of interactivity. Future self-compassion app developers should consider these weaknesses and aim at improving them. Otherwise these factors could prevent task completion, could create frustration or confusion and consequently, lead to low adherence rates (Price, 2014).

Limitations

The assessment of the theoretical bases, of the exercises and the persuasive design elements within the apps, was conducted by a single person simulating a walkthrough. Due to the fact, that the literature research didn't provide clear statements of which self-compassion exercise is aimed at improving which of the three self-compassion components, the applied subcategorization was interpretative and subjective in nature. The uMARS rating was conducted after the apps were checked for the presence of a theoretical framework and for the implementation of persuasive design elements. To avoid a possible confirmation bias, the uMARS could alternatively be rated at the very beginning of the study. The mentioned limitations can possibly affect the reproducibility of the results of this study.

Conclusion and Implications

The results lead to the conclusion, that despite the presence of an evidence based theoretical framework, current self-compassion apps lack verifiable sources regarding the theories upon which they are developed. This emphasizes the need for future developers to consider actual shortcomings and present theories and references, in order to make a beneficial improvement towards credibility support. Features of this category, such as trustworthiness, expertise and verifiability, can improve the persuasiveness of a system (Oinas-Kukkonen, & Harjumaa, 2009), and need to be incorporated into future self-compassion apps to achieve higher persuasiveness. The same implication applies to the other categories of persuasive elements within the evaluated apps. Future self-compassion apps should implement more self-monitoring to assist goal achievement. They should combine this feature with praises, rewards and reminders to stimulate and engage the users more. The CBT MobilWork (Tudeau, 2010) for example illustrates how a mobile app can make use of the opportunities mobile devices offer in its modalities. The app sends real-time feedback and accompanies the user while engaging in activity, sending motivational messages or suggestions on how to complete the exercise, whenever the user might disengage.

Future self-compassion app development should also consider targeting specific groups during the developmental process, as well as age and sex differences that influence the adoption of

mHealth apps (Hussein, Harun, Oon, 2016). For example, asking the user facts about gender, age and occupation could subsequently change a pre-developed app lay-out with role models corresponding to collected information of the user.

One of the apps reached, with a considerable relative difference, higher total scores in all assessed categories. The MindSpace app laid the foundation of how a self-compassion app can look like. It therefore represents a recommendation to be used by millennials. Finally, the uMARS rating scale appeared to be a promising and timesaving evaluation tool, that should be considered for future mobile application evaluation studies.

Pocket Psychiatry for Millennials – Friend or Foe? The evaluated self-compassion apps have the potential to be *friends* with millennials. With the incorporated exercises, they can not only function as a buffer against negative life events, but also as a protective factor against psychopathology. However, most app developers acted as *foes. Foes* of the scientific insights of the last years, regarding persuasive systems design and usability. They should consider the found limitations, in order to develop the potential of pocket psychiatry to be *friends* with millennials.

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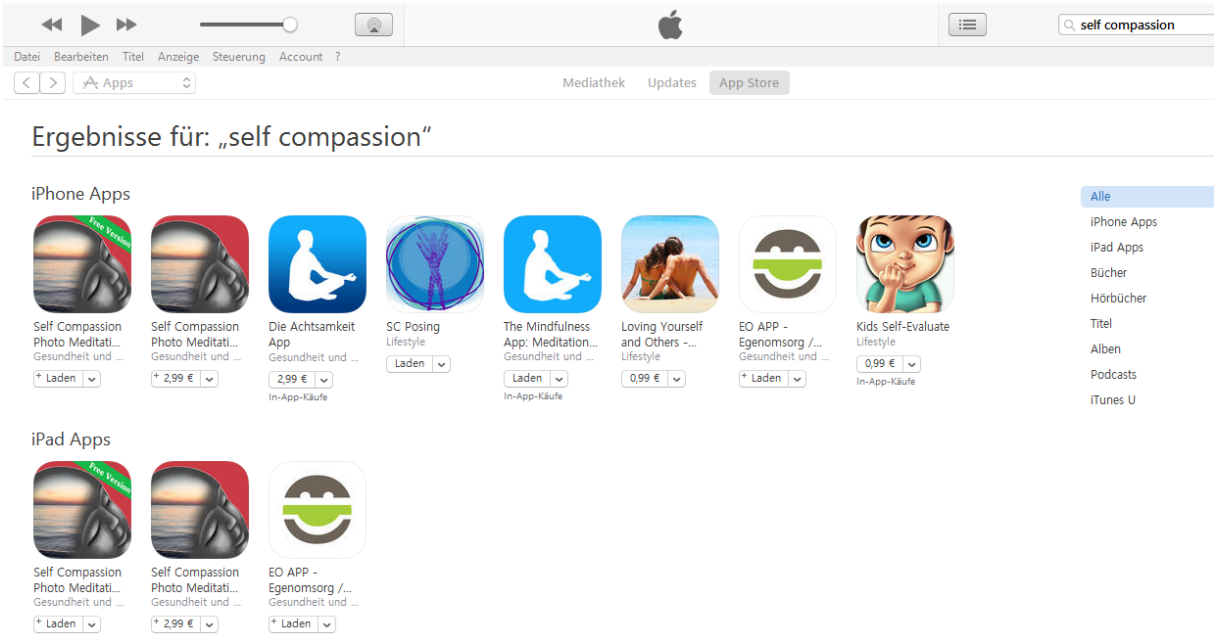
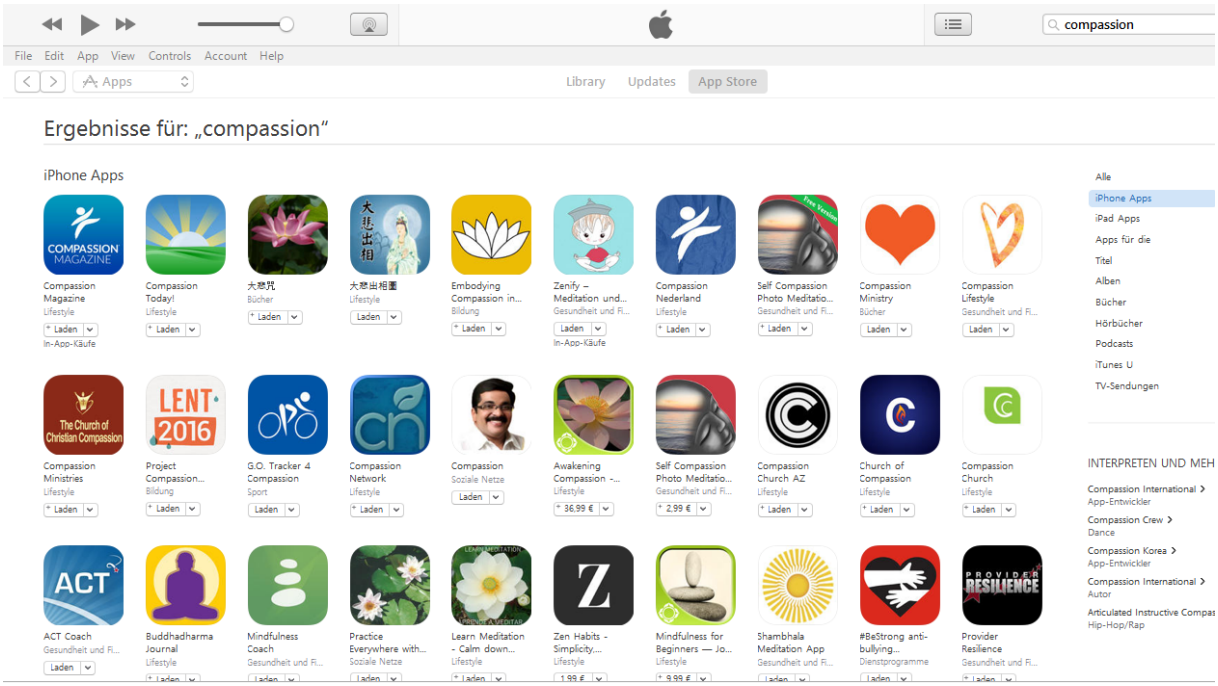
Appendix

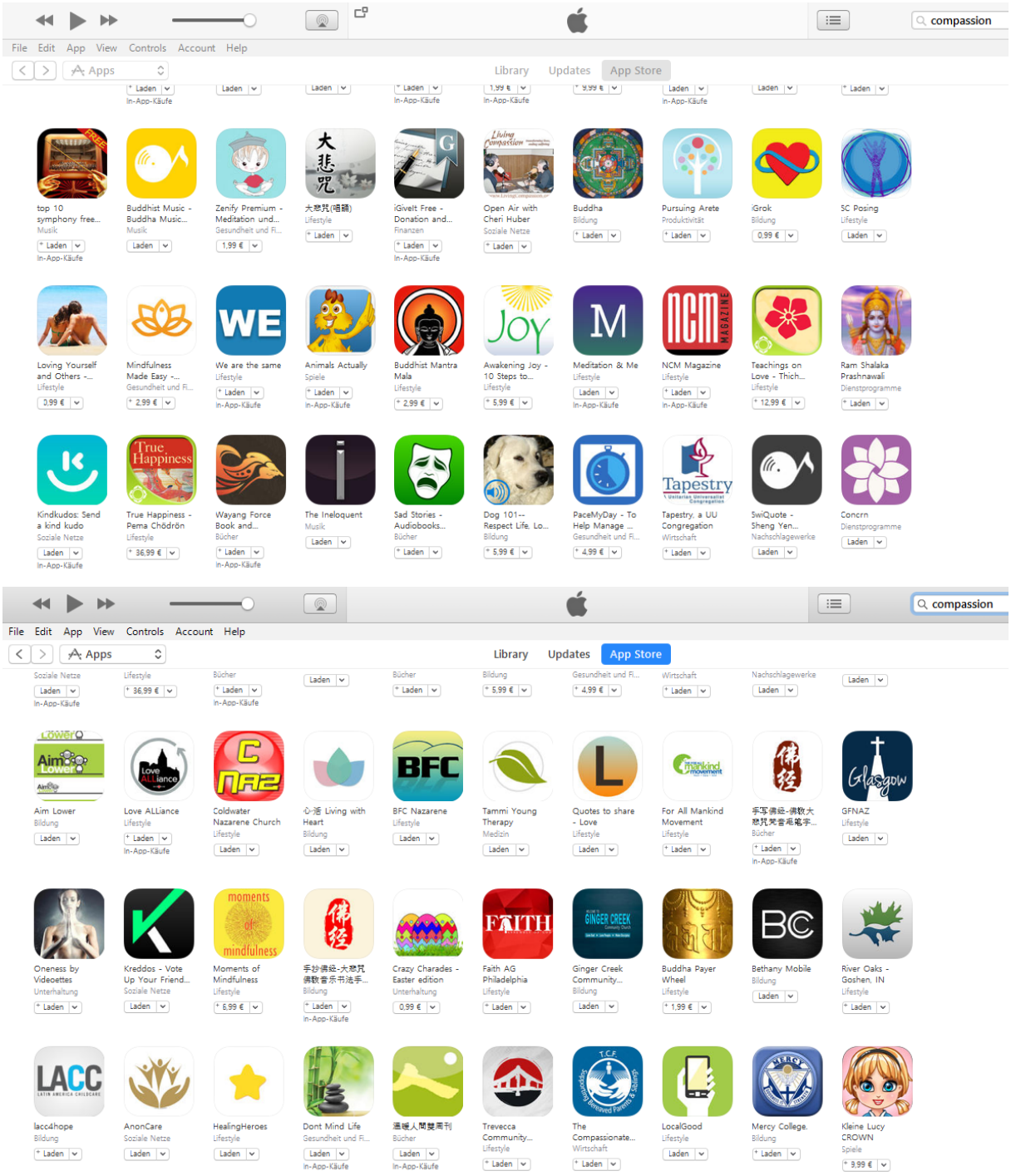
APPENDIX A: Screenshots of the conducted search on iTunes

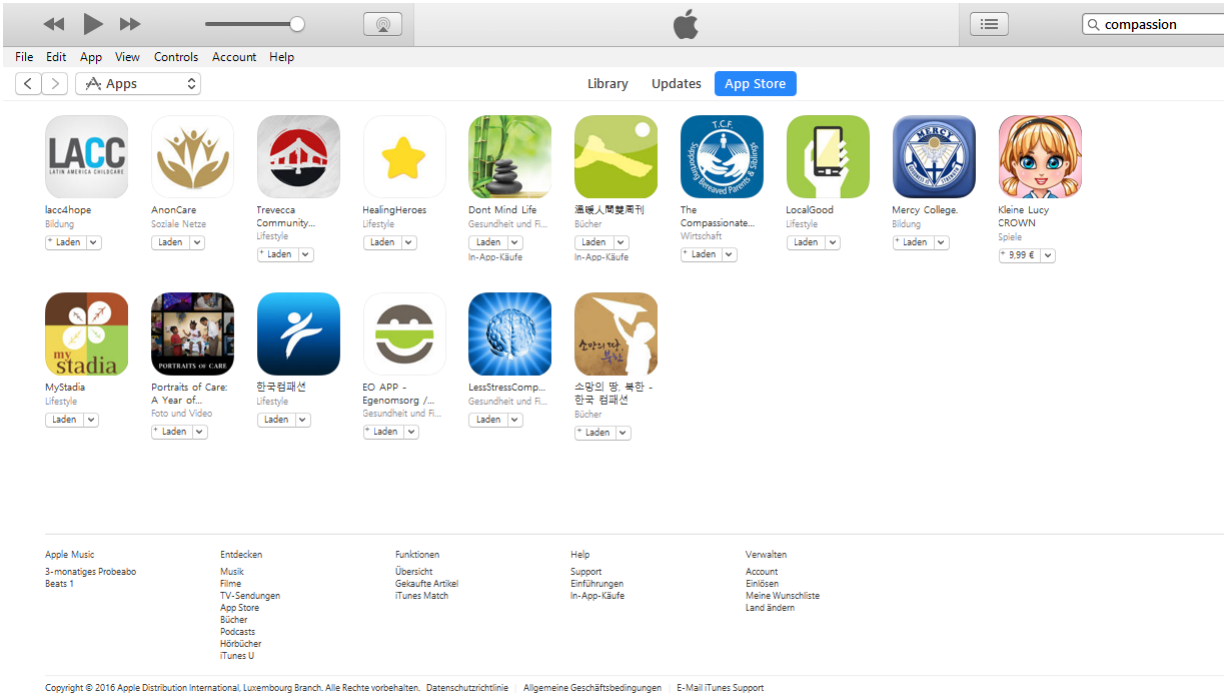
APPENDIX A.1: Screenshots of the search term “Self-compassion”



APPENDIX A.2: Screenshots of the search term “Compassion”




compassion
File Edit App View Controls Account Help
Apps
Library
Updates
App Store
top 10 symphony free...
Buddhist Music - Buddha Music...
Zenify Premium - Meditation und...
大悲咒(唱頌)
iGivelt Free - Donation and...
Open Air with Cheri Huber
Buddha
Pursuing Arete
iGrok
SC Posing
Loving Yourself and Others -...
Mindfulness Made Easy -...
We are the same
Animals Actually
Buddhist Mantra Mala
Awakening Joy - 10 Steps to...
Meditation & Me
NCM Magazine
Teachings on Love - Thich...
Ram Shalaka Prashnawali
Kindkudos: Send a kind kudo
True Happiness - Pema Chödrön
Wayang Force Book and...
The Ineloquent
Sad Stories - Audiobooks...
Dog 101-- Respect Life, Lo...
PaceMyDay - To Help Manage ...
Tapestry, a UU Congregation
SwiQuote - Sheng Yen...
Concrn
compassion
File Edit App View Controls Account Help
Apps
Library
Updates
App Store
Aim Lower
Love ALLiance
Coldwater Nazarene Church
心活 Living with Heart
BFC Nazarene
Tammi Young Therapy
Quotes to share - Love
For All Mankind Movement
GFNAZ
Oneness by Videoettes
Kreddos - Vote Up Your Friend...
Moments of Mindfulness
Crazy Charades - Easter edition
Faith AG Philadelphia
Ginger Creek Community...
Buddha Payer Wheel
Bethany Mobile
River Oaks - Goshen, IN
lacc4hope
AnonCare
HealingHeroes
Dont Mind Life
Trevecca Community...
The Compassionate...
LocalGood
Mercy College.
Kleine Lucy CROWN


compassion
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Updates
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Bildung
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AnonCare
Soziale Netze
Laden
Trevecca Community...
Lifestyle
Laden
HealingHeroes
Lifestyle
Laden
Dont Mind Life
Gesundheit und Fi...
Laden
In-App-Käufe
Laden
In-App-Käufe
The Compassionate...
Wirtschaft
Laden
LocalGood
Lifestyle
Laden
Mercy College.
Bildung
Laden
Kleine Lucy
CROWN
Spiele
9,99 €
MyStadia
Lifestyle
Laden
Portraits of Care: A Year of...
Foto und Video
Laden
한국컴패션
Lifestyle
Laden
EO APP - Egenomsorg /...
Gesundheit und Fi...
Laden
LessStressComp...
Gesundheit und Fi...
Laden
소망의 땅, 북한 - 한국 컴패션
Bücher
Laden
Apple Music
3-monatiges Probeabo
Beats 1
Entdecken
Musik
Filme
TV-Sendungen
App Store
Bücher
Podcasts
Hörbücher
iTunes U
Funktionen
Übersicht
Gekaufte Artikel
iTunes Match
Help
Support
Einführungen
In-App-Käufe
Verwalten
Account
Einlösen
Meine Wunschliste
Land ändern
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APPENDIX B: Evidence based self-compassion exercises

Name of exercise	Description	URL
Affectionate Breathing	no description available	http://self-compassion.org/category/exercises/
Compassionate Body Scan	no description available	http://self-compassion.org/category/exercises/
Loving-kindness Meditation	silently repeat three lovingkindness phrases, directed at others and themselves, every night before going to bed (e.g., “may you be at peace,” “may you be kind to yourself,” “may you be free from suffering”).	http://self-compassion.org/category/exercises/
Self-Compassion-Loving-Kindness Meditation	no description available	http://self-compassion.org/category/exercises/
Noting your Emotions/ Labeliing emotions	no description available	http://self-compassion.org/category/exercises/
Soften, soothe, allow: working with emotions in the body	no description available	http://self-compassion.org/category/exercises/
How would you treat a friend?	How do you think things might change if you responded to yourself in the same way you typically respond to a close friend when he or she is suffering?	http://self-compassion.org/category/exercises/
Self-compassion Break	will help you remember to evoke the three aspects of self-compassion in the moment you need it most	http://self-compassion.org/category/exercises/
Exploring SC through writing	Everybody has something about themselves that they don’t like; something that causes them to feel shame, to feel insecure, or not “good enough.” This exercise will help you write a letter to yourself about this issue from a place of acceptance and compassion.	http://self-compassion.org/category/exercises/

The criticizer, the criticized, and the compassionate observer	In this exercise, you will sit in different chairs to help get in touch with different, often conflicting parts of yourself (the criticizer, the criticized, and the compassionate observer), experiencing how each aspect feels in the present moment.	http://self-compassion.org/category/exercises/
Changing yout critical self-talk	By acknowledging your self-critical voice and reframing its observations in a more friendly way, you will eventually form the blueprint for changing how you relate to yourself long-term.	http://self-compassion.org/category/exercises/
Self-compassion Journal	Keeping a daily journal in which you process the difficult events of your day through a lens of self-compassion can enhance both mental and physical well-being. This exercise will help make self-kindness, common humanity, and mindfulness part of your daily life.	http://self-compassion.org/category/exercises/
Identifying what we really want	Remember that if you really want to motivate yourself, love is more powerful than fear. In this exercise, you'll reframe your inner dialogue so that it is more encouraging and supportive.	http://self-compassion.org/category/exercises/
Taking care of the caregiver	This exercise will allow you to keep your heart open and help you care for and nurture yourself at the same time you're caring for and nurturing others.	http://self-compassion.org/category/exercises/
Soothing touch	One easy way to soothe and comfort yourself when you're feeling badly is to give yourself a gentle hug or caress, or simply put your hand on your heart and feel the warmth of your hand. It may feel awkward or embarrassing at first, but your body doesn't know that. It just responds to the physical gesture of warmth and care, just as a baby responds to being cuddled in its mother's arms. Our skin is an incredibly sensitive organ. Research indicates that physical touch releases oxytocin, provides a sense of security, soothes distressing emotions, and calms cardiovascular stress.	http://www.mindfulselfcompassion.org/resources_handouts.php
Sense and savor walk	The goal of the walk is to notice as many pleasurable things as possible, slowly, one after another. Using all your senses—sight, smell, sound, touch… maybe even taste.	http://www.mindfulselfcompassion.org/resources_handouts.php
Forgiveness	forgiving others and yourself	http://www.mindfulselfcompassion.org/resources_handouts.php

Intervention Bracelet	participants had to switch their “intervention bracelet” from one arm to the other every time they addressed themselves in a harsh way or felt upset about something	MSC
Soles of the feet	This is a very effective way to anchor your awareness in body sensation, especially when you’re upset and can’t calm yourself down. • Stand up and feel your feet, especially how they feel pressing against the floor. • ·Now walk slowly. As you walk, simply notice how your feet feel. When your mind wanders, just feel your feet again. Notice the changes in sensation as you lift your foot, step forward, and place your foot back down on the floor. • ·Practice until you feel more relaxed.	http://centerformsc.org/practice-msc/guided-meditations-and-exercises/
Finding phrases	no description available	http://centerformsc.org/practice-msc/guided-meditations-and-exercises/
Giving an receiving compassion	no description available	http://centerformsc.org/practice-msc/guided-meditations-and-exercises/

APPENDIX C: Persuasive systems Design principles

Retrieved from Oinas-Kukkonen, H., & Harjumaa, M., 2009. Persuasive Sytems Design: Key Issues, Process Model, and System Features. Communications of the Association for Information Systems. 24(1), Article 28. Available at: http://aisel.aisnet.org/cais/vol24/iss1/28

Appendix C.1: Primary Task Support principles and examples

Appendix C.2: Dialogue Support principles and examples

Table 3. Dialogue Support

Principle	Example requirement	Example implementation
Praise By offering praise, a system can make users more open to persuasion.	System should use praise via words, images, symbols, or sounds as a way to provide user feedback information based on his/her behaviors.	Mobile application that aims at motivating teenagers to exercise praises user by sending automated text-messages for reaching individual goals. [Toscos et al. 2006]
Rewards Systems that reward target behaviors may have great persuasive powers.	System should provide virtual rewards for users in order to give credit for performing the target behavior.	Heart rate monitor gives users a virtual trophy if they follow their fitness program. Game rewards users by altering media items, such as sounds, background skin, or a user's avatar according to user's performance. [Sohn and Lee 2007]
Reminders If a system reminds users of their target behavior, the users will more likely achieve their goals.	System should remind users of their target behavior during the use of the system.	Caloric balance monitoring application sends text-messages to its users as daily reminders. [Lee et al. 2006]
Suggestion Systems offering fitting suggestions will have greater persuasive powers.	System should suggest that users carry out behaviors during the system use process.	Application for healthier eating habits suggests that children eat fruits instead of candy at snack time.
Similarity People are more readily persuaded through systems that remind them of themselves in some meaningful way.	System should imitate its users in some specific way.	Slang names are used in an application which aims at motivating teenagers to exercise. [Toscos et al. 2006]
Liking A system that is visually attractive for its users is likely to be more persuasive.	System should have a look and feel that appeals to its users.	Web site that aims at encouraging children to take care of their pets properly has pictures of cute animals.
Social role If a system adopts a social role, users will more likely use it for persuasive purposes.	System should adopt a social role.	E-health application has a virtual specialist to support communication between users and health specialists. [Silva et al. 2006]

Appendix C.3: System Credibility Support principles and examples

Table 4. System Credibility Support

Principle	Example requirement	Example implementation
Trustworthiness A system that is viewed as trustworthy will have increased powers of persuasion.	System should provide information that is truthful, fair and unbiased.	Company Web site provides information related to its products rather than simply providing biased advertising or marketing information.
Expertise A system that is viewed as incorporating expertise will have increased powers of persuasion.	System should provide information showing knowledge, experience, and competence.	Company Web site provides information about their core knowledge base. Mobile application is updated regularly and there are no dangling links or out-of-date information.
Surface credibility People make initial assessments of the system credibility based on a firsthand inspection.	System should have competent look and feel.	There are only a limited number of, and a logical reason for, ads on a Web site or mobile application.
Real-world feel A system that highlights people or organization behind its content or services will have more credibility.	System should provide information of the organization and/or actual people behind its content and services.	Company Web site provides possibilities to contact specific people through sending feedback or asking questions.
Authority A system that leverages roles of authority will have enhanced powers of persuasion.	System should refer to people in the role of authority.	Web site quotes an authority, such as a statement by government health office.
Third-party endorsements Third-party endorsements, especially from well-known and respected sources, boost perceptions on system credibility.	System should provide endorsements from respected sources.	E-shop shows a logo of a certificate that assures that they use secure connections. Web site refers to its reward for high usability.
Verifiability Credibility perceptions will be enhanced if a system makes it easy to verify the accuracy of site content via outside sources.	System should provide means to verify the accuracy of site content via outside sources.	Claims on a Web site are supported by offering links to other web sites.

Appendix C.4: Social Support principles and examples

Table 5: Social support

Principle	Example requirement	Example implementation
Social learning A person will be more motivated to perform a target behavior if (s)he can use a system to observe others performing the behavior.	System should provide means to observe other users who are performing their target behaviors and to see the outcomes of their behavior.	A shared fitness journal in a mobile application for encouraging physical activity [Consolvo et al. 2006].
Social comparison System users will have a greater motivation to perform the target behavior if they can compare their performance with the performance of others.	System should provide means for comparing performance with the performance of other users.	Users can share and compare information related to their physical health and smoking behavior via instant messaging application [Sohn and Lee 2007].
Normative influence A system can leverage normative influence or peer pressure to increase the likelihood that a person will adopt a target behavior.	System should provide means for gathering together people who have the same goal and make them feel norms.	A smoking cessation application shows pictures of newborn babies with serious health problems due to the mother's smoking habit.
Social facilitation System users are more likely to perform target behavior if they discern via the system that others are performing the behavior along with them.	System should provide means for discerning other users who are performing the behavior.	Users of a computer-based learning environment can recognize how many co-students are doing their assigned homework at the same time as them.
Cooperation A system can motivate users to adopt a target attitude or behavior by leveraging human beings' natural drive to co-operate.	System should provide means for co-operation.	The behavioral patterns of overweight patients are studied through a mobile application, which collects data and sends it to a central server where it can be analyzed at the group level in more detail [Lee et al. 2006].
Competition A system can motivate users to adopt a target attitude or behavior by leveraging human beings' natural drive to compete.	System should provide means for competing with other users.	Online competition, such as Quit and Win (stop smoking for a month and win a prize).
Recognition By offering public recognition for an individual or group, a system can increase the likelihood that a person/group will adopt a target behavior.	System should provide public recognition for users who perform their target behavior.	Names of awarded people, such as "stopper of the month," are published on a Web site. Personal stories of the people who have succeeded in their goal behavior are published on a smoking cessation Web site.

APPENDIX D: uMARS

Instructions for use:

Raters should:

1. Use the app and trial it thoroughly for at least 10 minutes;
2. Determine how easy it is to use, how well it functions and does it do what it purports to do;
3. Review app settings, developer information, external links, security features, etc.

Scoring

A: Engagement Mean Score = _____

B: Functionality Mean Score = _____

C: Aesthetics Mean Score = _____

D: Information Mean Score* = _____

* Exclude questions rated as "N/A" from the mean score calculation.

App quality mean score _____= A + B + C + D / 4

The *App subjective quality* scale can be reported as individual items or as a mean score, depending on the aims of the research.

The *Perceived impact* items can be adjusted and used to obtain information on the perceived impact of the app on the user's knowledge, attitudes and intentions related to the target health behaviour.

Mobile Application Rating Scale: user version (uMARS)

App Name: _____

Circle the number that most accurately represents the quality of the app you are rating. All items are rated on a 5-point scale from "1.Inadequate" to "5.Excellent". Select N/A if the app component is irrelevant.

App Quality Ratings

SECTION A

Engagement – fun, interesting, customisable, interactive, has prompts (e.g. sends alerts, messages, reminders, feedback, enables sharing)

1. **Entertainment: Is the app fun/entertaining to use? Does it have components that make it more fun than other similar apps?**
   1 Dull, not fun or entertaining at all
   2 Mostly boring
   3 OK, fun enough to entertain user for a brief time (< 5 minutes)
   4 Moderately fun and entertaining, would entertain user for some time (5-10 minutes total)
   5 Highly entertaining and fun, would stimulate repeat use

2. **Interest: Is the app interesting to use? Does it present its information in an interesting way compared to other similar apps?**
   1 Not interesting at all
   2 Mostly uninteresting
   3 OK, neither interesting nor uninteresting; would engage user for a brief time (< 5 minutes)
   4 Moderately interesting; would engage user for some time (5-10 minutes total)
   5 Very interesting, would engage user in repeat use

3. **Customisation: Does it allow you to customise the settings and preferences that you would like to (e.g. sound, content and notifications)?**
   1 Does not allow any customisation or requires setting to be input every time
   2 Allows little customisation and that limits app's functions
   3 Basic customisation to function adequately
   4 Allows numerous options for customisation
   5 Allows complete tailoring the user's characteristics/preferences, remembers all settings

4. **Interactivity: Does it allow user input, provide feedback, contain prompts (reminders, sharing options, notifications, etc.)?**
   1 No interactive features and/or no response to user input
   2 Some, but not enough interactive features which limits app's functions
   3 Basic interactive features to function adequately
   4 Offers a variety of interactive features, feedback and user input options
   5 Very high level of responsiveness through interactive features, feedback and user input options

5. **Target group: Is the app content (visuals, language, design) appropriate for the target audience?**
   1 Completely inappropriate, unclear or confusing
   2 Mostly inappropriate, unclear or confusing
   3 Acceptable but not specifically designed for the target audience. May be inappropriate/ unclear/confusing at times
   4 Designed for the target audience, with minor issues
   5 Designed specifically for the target audience, no issues found

SECTION B

Functionality – app functioning, easy to learn, navigation, flow logic, and gestural design of app

6. **Performance: How accurately/fast do the app features (functions) and components (buttons/menus) work?**
   1 App is broken; no/insufficient/inaccurate response (e.g. crashes/bugs/broken features, etc.)
   2 Some functions work, but lagging or contains major technical problems
   3 App works overall. Some technical problems need fixing, or is slow at times
   4 Mostly functional with minor/negligible problems
   5 Perfect/timely response; no technical bugs found, or contains a 'loading time left' indicator (if relevant)

7. **Ease of use: How easy is it to learn how to use the app; how clear are the menu labels, icons and instructions?**
   1 No/limited instructions; menu labels, icons are confusing; complicated
   2 Takes a lot of time or effort
   3 Takes some time or effort
   4 Easy to learn (or has clear instructions)
   5 Able to use app immediately; intuitive; simple (no instructions needed)

8. **Navigation: Does moving between screens make sense; Does app have all necessary links between screens?**
   1 No logical connection between screens at all /navigation is difficult
   2 Understandable after a lot of time/effort
   3 Understandable after some time/effort
   4 Easy to understand/navigate
   5 Perfectly logical, easy, clear and intuitive screen flow throughout, and/or has shortcuts

9. **Gestural design: Do taps/swipes/pinches/scrolls make sense? Are they consistent across all components/screens?**
   1 Completely inconsistent/confusing
   2 Often inconsistent/confusing
   3 OK with some inconsistencies/confusing elements
   4 Mostly consistent/intuitive with negligible problems
   5 Perfectly consistent and intuitive

SECTION C

Aesthetics – graphic design, overall visual appeal, colour scheme, and stylistic consistency

10. Layout: Is arrangement and size of buttons, icons, menus and content on the screen appropriate?

1 Very bad design, cluttered, some options impossible to select, locate, see or read
2 Bad design, random, unclear, some options difficult to select/locate/see/read
3 Satisfactory, few problems with selecting/locating/seeing/reading items
4 Mostly clear, able to select/locate/see/read items
5 Professional, simple, clear, orderly, logically organised

11. Graphics: How high is the quality/resolution of graphics used for buttons, icons, menus and content?

1 Graphics appear amateur, very poor visual design - disproportionate, stylistically inconsistent
2 Low quality/low resolution graphics; low quality visual design – disproportionate
3 Moderate quality graphics and visual design (generally consistent in style)
4 High quality/resolution graphics and visual design – mostly proportionate, consistent in style
5 Very high quality/resolution graphics and visual design - proportionate, consistent in style throughout

12. Visual appeal: How good does the app look?

1 Ugly, unpleasant to look at, poorly designed, clashing, mismatched colours
2 Bad – poorly designed, bad use of colour, visually boring
3 OK – average, neither pleasant, nor unpleasant
4 Pleasant – seamless graphics – consistent and professionally designed
5 Beautiful – very attractive, memorable, stands out; use of colour enhances app features/menus

SECTION D

Information – Contains high quality information (e.g. text, feedback, measures, references) from a credible source

13. Quality of information: Is app content correct, well written, and relevant to the goal/topic of the app?

N/A There is no information within the app
1 Irrelevant/inappropriate/incoherent/incorrect
2 Poor. Barely relevant/appropriate/coherent/may be incorrect
3 Moderately relevant/appropriate/coherent/and appears correct
4 Relevant/appropriate/coherent/correct
5 Highly relevant, appropriate, coherent, and correct

14. Quantity of information: Is the information within the app comprehensive but concise?

N/A There is no information within the app
1 Minimal or overwhelming
2 Insufficient or possibly overwhelming
3 OK but not comprehensive or concise
4 Offers a broad range of information, has some gaps or unnecessary detail; or has no links to more information and resources
5 Comprehensive and concise; contains links to more information and resources

15. Visual information: Is visual explanation of concepts – through charts/graphs/images/videos, etc. – clear, logical, correct?

N/A There is no visual information within the app (e.g. it only contains audio, or text)
1 Completely unclear/confusing/wrong or necessary but missing
2 Mostly unclear/confusing/wrong
3 OK but often unclear/confusing/wrong
4 Mostly clear/logical/correct with negligible issues
5 Perfectly clear/logical/correct

16. Credibility of source: does the information within the app seem to come from a credible source?

N/A There is no information within the app
1 Suspicious source
2 Lacks credibility
3 Not suspicious but legitimacy of source is unclear
4 Possibly comes from a legitimate source
5 Definitely comes from a legitimate/specialised source

App subjective quality

SECTION E

17. Would you recommend this app to people who might benefit from it?

1	Not at all	I would not recommend this app to anyone
2		There are very few people I would recommend this app to
3	Maybe	There are several people I would recommend this app to
4		There are many people I would recommend this app to
5	Definitely	I would recommend this app to everyone

18. How many times do you think you would use this app in the next 12 months if it was relevant to you?

1 None
2 1-2
3 3-10
4 10-50
5 >50

19. Would you pay for this app?

1 Definitely not
2
3
4
5 Definitely yes

20. What is your overall (star) rating of the app?

1	★	One of the worst apps I've used
2	★★	
3	★★★	Average
4	★★★★	
5	★★★★★	One of the best apps I've used

Perceived impact

SECTION F

1. **Awareness – This app has increased my awareness of the importance of addressing the health behaviour**

Strongly disagree 1 2 3 4 5 Strongly Agree

2. **Knowledge – This app has increased my knowledge/understanding of the health behaviour**

Strongly disagree 1 2 3 4 5 Strongly Agree

3. **Attitudes – The app has changed my attitudes toward improving this health behaviour**

Strongly disagree 1 2 3 4 5 Strongly Agree

4. **Intention to change – The app has increased my intentions/motivation to address this health behaviour**

Strongly disagree 1 2 3 4 5 Strongly Agree

5. **Help seeking – This app would encourage me to seek further help to address the health behaviour (if I needed it)**

Strongly disagree 1 2 3 4 5 Strongly Agree

6. **Behaviour change – Use of this app will increase/decrease the health behaviour**

Strongly disagree 1 2 3 4 5 Strongly Agree

Further comments about the app?

THANK YOU!

Queensland University of Technology

YOUNGANDWELL Cooperative Research Centre