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Online First Publication, April 21, 2022. http://dx.doi.org/10.1037/pmu0000286

CITATION
Duguid, T., Mansour, S., Garrido, S., & Chmiel, A. (2022, April 21). MoodyTunes: A Mixed Methods Usability Study of an App for Adolescent Mental Health. *Psychomusicology: Music, Mind, and Brain*. Advance online publication. http://dx.doi.org/10.1037/pmu0000286

AMERICAN PSYCHOLOGICAL ASSOCIATION

Psychomusicology: Music, Mind, and Brain

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ISSN: 0275-3987

https://doi.org/10.1037/pmu0000286

MoodyTunes: A Mixed Methods Usability Study of an App for Adolescent Mental Health

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Suicide is the leading cause of death in young people around the world, with depression as a major driver of these numbers. However, a substantial percentage of young people with depression do not seek professional help. As people in this demographic report listening should be to up to 5 hrs of music per day, music has the potential to serve as an effective method of reaching young people and increase their mental health literacy. *MoodyTunes* is an in-development mHealth app that aims to increasing mental health awareness in young people and to inform young people about how music can be used as an effective tool for self-regulating mood. Here, we report a mixed methods usability study of *MoodyTunes* in which a sample of young people ($N = 20$, age range: 12–25) experienced the app for the first time. A think-aloud method was used to evaluate the app, alongside quantitative survey responses, automated facial analysis data, and interview data. Survey data indicated that the app was perceived in a positive manner, and as effective and well-functioning, whereas aesthetic appeal received the lowest score. As hypothesized, women and younger participants displayed more positive emotions while using the app. Qualitative data indicated several positive aspects such as links to mental health resources and the ability to share music with others, but also highlighted the need to improve the aesthetic appeal, ease of use, and capacity to personalize the app. Future considerations and approaches for mHealth apps, as well as limitations in the present study, are discussed.

Keywords: moodytunes, mental health app, usability, music, adolescents

Supplemental materials: https://doi.org/10.1037/pmu0000286.supp

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Suicide is the leading cause of death around the world for young people aged 15 to 29 (WHO, 2017). An estimated 10% to 20% of children and adolescents worldwide are affected by mental health problems such as depression (Carrellas et al., 2017), and young suicide attempters are significantly more likely to have persistent mental health difficulties, including major depressive disorder (Goldman-Mellor et al., 2014). Living with depression can lead to significant reductions in social well-being (Santini et al., 2015) and work productivity (Rost et al., 2014) and is associated with national financial impacts (McDonald, 2019). These concerns are further exacerbated by findings that only one in five adolescents will seek professional help (Lawrence et al., 2016), with young adults and men particularly likely to avoid seeking professional support (Magaard et al., 2017). However, early intervention can play a critical role in promoting adolescent well-being and reducing anxiety and depression (Schotanus-Dijkstra et al., 2017). As such, there is a crucial need to develop highly innovative avenues to reach out to adolescents not yet accessing professional services.

Since the digital revolution, the accessibility and popularity of technology among youth is continually evolving (Brown & Bobkowski, 2011). Adolescents experiencing depression often engage in higher levels of overall media usage (Block et al., 2014), displaying online help-seeking behaviors as opposed to accessing in-person services (Burns et al., 2010; Rickwood et al., 2015). In one randomized controlled trial of a computer-based treatment for depression (Meyer et al., 2009) the majority (74%) of participants felt the program was equivalent to or better than a real therapist, and 95% said they would recommend the program to others. In addition, a meta-analysis of multiple digital mental health interventions concluded that those delivered via a web-based or mobile app can be as successful as direct treatment for depression (Andersson et al., 2014).

Despite being effective (Andersson et al., 2014), a key challenge is making mental health interventions engaging. One recent systematic review (Garrido et al., 2019) found that digital mental health interventions tend to be mostly effective when delivered in conjunction with other therapies, or when used in supervised

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Tara Duguid and Sarah Mansour contributed equally to this work. The data used in this research were analyzed as part of the requirements of B. Psych (Hons) degrees by Tara Duguid and Sarah Mansour, and some of the ideas in this article were included in those theses.

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settings such as at school, suggesting that they are not broadly appealing to those young people who are not already seeking support. According to this review participants sometimes report being displeased with the educational content of such interventions, reporting them as unengaging. Indeed, some studies have found engagement rates with such apps as low as 10% (Twomey & O'Reilly, 2017), with particularly low rates of engagement in men (Dowling & Rickwood, 2013).

Music can be one way to engage young people in the usability of mHealth apps, with 80% of people across all age groups reporting using music to assist them in periods of distress (Australian Psychological Society, 2015). Adolescents particularly display heightened emotional dependency on music during times of depression (Gay et al., 2016). It has been observed that when young people are in a negative state of mind, they tend to remove themselves from social contact (O'Keeffe & Clarke-Pearson, 2011) and instead increase their usage of media, including listening to music (McFerran, 2016).

However, regardless of that fact that the popular media has often vilified particular "problem" genres of music such as metal and rap (Lozon & Bensimon, 2014; Powell et al., 2021), research has demonstrated that the effects of music listening on mental health are contingent upon the individual's coping style (Horwitz et al., 2018; Renaud et al., 2014) and cognitive awareness (Garrido et al., 2019; Stewart et al., 2019). Music is not always used effectively by people experiencing depression, which is associated with high levels of maladaptive coping (Renaud et al., 2014) including emotion-oriented (Miranda & Claes, 2008) and ruminative coping (Garrido et al., 2019; Stewart et al., 2019) as well as avoidant coping (McFerran & Saarikallio, 2014; White Hughto et al., 2017). Those with a ruminative coping style—which is highly predictive of clinical depression—display higher interests in listening to music that can intensify depression symptomatology (Garrido & Schubert, 2013).

In fact, it is common for individuals in a depressed mood to demonstrate a reduced liking for energetic music (Punkanen et al., 2011) and a preference for sad music (Stewart et al., 2019; Yoon et al., 2020). This can sometimes have the effect of maintaining a depressive mood (Miranda & Claes, 2008; Stewart et al., 2019). Research has shown that youths with depression are often not aware of how to select appropriate music to improve their mood (Wilhelm et al., 2013), and may be oblivious to its potential for negative outcomes if used to intensify distressful emotions (Cheong-Clinch & McFerran, 2016).

Nevertheless, studies have shown that it is possible for young people to develop more effective strategies for music use with increased awareness of the effect that music is having on their moods (McFerran & Saarikallio, 2014). For example, one study found that use of a thought diary to record responses to music allowed individuals to become conscious of the effect of music on their moods, and hence to change their listening strategies (Garrido et al., 2016). Similarly, other research has shown that young people may begin to select music with greater awareness after the intervention of friends, family or a therapist (Stewart et al., 2019).

The fact that music is highly engaging to young people experiencing psychological distress, and that it can have a critical influence on mental health, led to the development of *MoodyTunes*. *MoodyTunes* is a smartphone app developed in close collaboration with young people, using a participant-design framework to help young people increase awareness of the effects of their music listening and to make more constructive choices. An initial wave of development involved focus groups and codesign workshops with young people including those with lived experience of mental health issues. Findings from these workshops were then discussed and workshopped with a team that included experts in music psychology, clinical advisors, and other government and nongovernmental organization stakeholders with an interest in youth mental health. These discussions resulted in the development of a brief which outlined the concept and key features of the app. In the second phase of development a group of student developers built a wireframe for the app which was then taken back to our youth codesigners for feedback and further suggestions. Based on this feedback a brief was given to a professional app development team who built the *MoodyTunes* prototype for Android which was evaluated in the current study.

Building on principles of cognitive behavioral therapy, *MoodyTunes* works in the background while young people engage in their usual music listening through well-known streaming apps and prompts them to record mood responses to music and to engage in self-reflection around the thoughts and feelings associated with their responses to particular songs. The app also allows young people to diarize their responses to music, with the aim of helping them to better understand the relationship between music choices and mental health and to equip them with effective mood regulation strategies. *MoodyTunes* was not designed to replace professional mental health support or to be used in situations of crisis. It therefore contains links to professional support including suicide hotlines and other youth mental health resources, and aims to encourage increased uptake of those services through increasing mental health literacy.

The present study aimed to evaluate the usability and appeal of a first iteration of *MoodyTunes* to inform subsequent phases of its development. The study also aimed to investigate which features of the app were perceived as most appealing. Screenshots of *MoodyTunes* as it appeared in this first iteration are included in the online supplemental materials. Because previous research has also suggested that it is particularly challenging to engage male users in learning about mental health (Kenny et al., 2016) and that younger users are generally more comfortable and familiar with apps (Fuller-Tyszkiewicz et al., 2018), we also aimed to investigate whether there were gender or age differences in response to the app. In relation to the appeal of the app, it was hypothesized that:

Hypothesis 1: Users of *MoodyTunes* will display more positive emotions while using the app compared to a neutral baseline period

Hypothesis 2: Female users of *MoodyTunes* will display more positive emotions while using the app compared to male users

Hypothesis 3: Young users (aged 17 and below) will display more positive emotions while using *MoodyTunes* compared to older users (aged 18 and above).

Method

This study utilized a mixed methods design under a realism paradigm (Sobh & Perry, 2006), using multiple methods of data collection

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and varied analytical methods to compare perceptions. A concurrent nested design was used (Creswell et al., 2003) with both qualitative and quantitative data being collected within a single session. Self-report survey data were triangulated with objective facial expression analysis, think-aloud data and interview feedback.

Participants

A purposive sampling strategy was adopted with stratification of groups aiming for a balance of genders and age groups. Participants were required to be 12 to 25 years of age and able to read English. Participants were recruited via researcher networks, snowballing, and social media advertising. A total of 22 participants (10 males, 12 females) responded to recruitment advertisements. Participants were presented a prescreening survey, and were excluded if they produced scores greater than 14 on the Depression and Anxiety Stress Scale (Henry & Crawford, 2005) or reported suicidal ideation within the current week. Two participants were excluded based on these criteria and were referred to *Lifeline* and followed up appropriately. Thus, the total sample included 20 participants (10 males, 10 females) with age M = 17.5, SD = 4.3 (Table 1). Participants were offered a AUD $10 eGift card as incentive.

Procedure

Ethics approval was obtained by the Human Research Ethics Committee of Western Sydney University (approval number H13678). After expressing interest in the study, potential participants or their guardians (if under the age of 14) were e-mailed a participant information sheet and a prescreening survey. Eligible participants completed a consent form with parental consent also sought for underage participants. Because the study was performed during the COVID-19 pandemic, sessions were held individually in private residences using appropriate social distancing and hygiene procedures in accord with local guidelines at the time. All sessions took part in a private area with minimal external noise or distraction and took approximately one hour each.

At the commencement of each individual session a fresh install of *MoodyTunes* was performed and participants were asked to create an account. They were also asked to sign into their *Spotify* account or to create a free one to access their music. Participants were then asked to independently navigate their way through the app for as long as they required to familiarize themselves with the content, while articulating their thoughts, utilizing a think-aloud method (Nielsen, 1994). This approach is common when testing the usability of smartphone apps, enabling researchers to understand each individuals' personal and unfiltered experience with the app (Crane et al., 2017; Goh et al., 2013). Verbal responses and facial expressions were recorded. Once participants had sufficiently explored the app, a semistructured interview was carried out. Lastly, participants completed an online survey.

Table 1
Descriptive Statistics of Age by Participant Age Groups

Age (years)	n	M	SD
12–14	6	12.7	0.8
15–18	7	16.7	1.4
19–25	7	22.4	1.8

Materials

Participants viewed *MoodyTunes* on a Samsung Galaxy J2 Pro smartphone, which was connected to a wireless network. Sessions were recorded using the built-in camera in a Microsoft Surface Pro laptop. Surveys were completed on the same laptop using the Qualtrics (2005) platform. The survey consisted of 27 items adapted from the Suitability Assessment of Materials Instrument (Doak et al., 1996). Survey items are detailed in the online supplemental materials. The survey was grouped into six categories. Categories 1 to 5 (covering survey Items 1 to 24) relate to specific aspects of user experience and are henceforth referred to as separate "domains". As the sixth category refers to overall ratings of the app, it was analyzed separately to the five domains. In total, the six survey categories were as follows:

1. *Engagement* domain, containing five items;
2. *Functionality* domain, containing four items;
3. Aesthetic appeal (hence *Aesthetics*) domain, containing three items;
4. Credibility of information (hence *Information*) domain, containing five items;
5. *Perceived effectiveness* domain, containing seven items; and
6. *Subjective quality*, containing three items.

The 27 survey items are detailed in the online supplemental materials[1]. An interview guide was used to direct discussions in the semistructured interview. Questions related to the participants' impressions of the app and what they would recommend as improvements, but conversations were allowed to proceed naturally based on participants' responses. The researcher also asked for clarification about reactions that had occurred during the think-aloud session. Think-aloud sessions and the interview were transcribed automatically on an Apple iPhone XR using the smartphone app *Otter*.

Data Analysis

Video files were uploaded to Noldus FaceReader (Noldus, 2016), an automated facial coding software developed as a more efficient alternative to manual facial coding via the Facial Action Coding System (Ekman et al., 2002). FaceReader (FR) captures patterns of facial muscular activation, or action units (AU), classifying these patterns as indicators of basic emotions through automated algorithms (Skiendziel et al., 2019). With a basic emotion accuracy average of 88%, FR displays the best performance out of the main

[1] The survey items are detailed in the online supplemental materials to avoid an overly lengthy primary document, although they are important to properly understand the procedures in full, and some facets of the analysis.

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software tools for emotion classification (Lewinski et al., 2014; Stöckli et al., 2018).

To address the hypotheses, positive emotions were measured by AU6 (cheek raiser) and AU12 (lip corner puller); these two AUs are activated during Duchenne smiling, suggesting enjoyment and happiness (Perron & Roy-Charland, 2013). Although other AUs can be involved in expressions of positive emotions, previous research has found that these AUs have the most robust correlations between manual and automatic coding (Olszanowski et al., 2008; Skiendziel et al., 2019). Median scores for each AU of interest were generated for both the test condition and the baseline condition (prior to using the app). For examination of Hypothesis 2, participants were divided at the median into a younger (12–17 years) and older age group (18–25 years).

As detailed in the online supplemental materials, 24 of the 27 survey items used a 5-point rating scale with "1" corresponding to the most negative response, and "5" corresponding to the most positive response. The remaining three items, which were each contained within the *Information* domain, also contained a sixth rating scale option that was always presented first, and corresponded to "N/A." Any "N/A" responses were removed from the dataset; this led to one response being removed for Item 14.

Analysis was performed by two of the authors independently of the quantitative data analysis in order not to be influenced by quantitative hypotheses and findings. Transcripts from Otter were edited for accuracy and analyzed using principles drawn from Clarke and Braun's (2013) six-step approach to thematic analysis. The authors first familiarized themselves with the data through editing and rereading the transcripts. Second, key points were refined to generate codes such as "thrown to the deep end", and "reconstruction of first page." Third, codes were revised and grouped into major themes and subthemes. The fourth step involved reviewing these themes and refining them to establish their relevance to the research questions. The fifth step involved further refining of themes and categorization into three major themes: (a) engagement and appeal, (b) ease of use, and (c) personalization. Quantitative and qualitative data analysis was performed independently by different pairs of team members. The team as a whole then consulted and compared qualitative and quantitative findings to integrate the findings into a coherent whole with qualitative data providing confirmation or context for the findings.

Results

First, normality of all quantitative data were examined with Shapiro-Wilk tests. These tests confirmed violations of normality. As distributions contained similar shape and variability, nonparametric analyses based on median values were used. The mean and *SD* ratings for each item in the survey are reported in the online supplemental materials, whereas the following sections report data grouped by AU or survey category.

Engagement and Aesthetic Appeal of *MoodyTunes*

To address Hypothesis 1, a Wilcoxon Signed-Rank test was conducted between the medians for AU6 at baseline and test. As hypothesized, the test condition ($Mdn = .20$, $Range = 13.80$) was significantly higher than the baseline ($Mdn < .01$, $Range < .01$), with a medium effect size, z ($N = 20$) = 3.06, $p = .002$, $r^2 = .23$. A similar analysis was conducted for AU12. The median score for the test ($Mdn = 4.95$, $Range = 14.60$) was again significantly higher than baseline ($Mdn < .01$, $Range < .01$), with a medium to large effect size, z ($N = 20$) = 3.62, $p < .001$, $r^2 = .33$. Thus, the findings for both AU6 and AU12 supported Hypothesis 1.

Regarding survey rating for the three items in the subjective quality category, responses were somewhat positive. For Item 25, half of the sample ($n = 10$) reported that they would either recommend *MoodyTunes* to "many people" (a rating of "4" out of "5") or to "everyone" (a rating of "5"). For item 26, almost half of the sample reported that they would likely use *MoodyTunes* 10 or more times per year ($n = 9$, 45%, constituting a response of either "4" or "5"). In addition, for Item 27 ("What is your overall star rating of the app, from 1 being one of the worst to 5 being one of the best?") the app received a rating of $M = 3.1$, $SD = 1.2$. *M* and *SD* values for each domain, with items for each domain collapsed, are reported in Table 2. The domains functionality, information, and perceived effectiveness were tied as the three most highly rated domains, whereas the aesthetics domain attained the lowest rating.

Qualitative data confirmed that the app lacked aesthetic appeal, with participants suggesting that developers "reconstruct the app to feel a little bit more modern" (P6). For most participants, the home page left an unfavorable first impression, with a common finding that it was cluttered: "First page didn't look . . . it was not set up neatly . . . it was not really that aesthetically pleasing" (P4). One participant also stated that it "could use some work. Just yeah maybe if the layout was a bit cleaner . . . I just think bigger fonts, not as much cursive writing going on" (P2).

Comments in think-aloud sessions indicated that users generally did not like the colors used: "Really this blue makes you feel sick" (P6). Another participant stated,

> The colors were quite bright. I think if someone was, you know, feeling a little bit depressed or you know, sad, if they were talking about a site that's quite bright it might not be so appropriate . . . like that to me would set off so many emotions. (P8)

When the users were asked what colors they would prefer, many replied similarly stating, "neutral colors. Like stick with one color and go with it, because there was every color on there" (P10) as well as "maybe like soft light pink, light yellows, like they're more sort of appealing" (P5).

Most Appealing Features

The most appealing features of the app identified in the think-aloud sessions and interviews were (a) links to other resources, (b)

Table 2
Descriptive Statistics for Ratings by Survey Domain, With Questions within Each Domain Collapsed

Survey domain	*M*	*SD*	*Mdn*
Engagement	3.4	1.1	3
Functionality	3.7	1.2	4
Aesthetics	3.3	1.2	3
Information	3.7	1.1	4
Perceived effectiveness	3.7	1.0	4

Note. For item 14, within the *Information* domain, $N = 19$ as a single response of "N/A" was omitted from analyses.

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opportunities for connection with others via sharing music and links to professional support, and (c) the reflective diary that allows mood tracking over time. One participant stated while using the app: "Resources are cool. These articles are interesting. I like how it gives tips as well" (P5). P20 similarly stated, "It's so interesting, it's very thought provoking. There's a lot of resources like expanding my knowledge." One participant noted, however, that some resources could be updated.

Participants also valued opportunities to connect with others: "I like to know that other people are using the app as well . . . makes you feel like people know what you're going through" (P5). Another participant stated: "you're not just stuck with your music and you can experience others and how they react to it, how they feel about it" (P4). Others appreciated the access offered to professional support, with assertions recorded such as: "I like that you have that access to help if you really need it" (P11). However, P20 observed that more support options could be added.

The mood tracking features also received positive comments: "Honestly, I think my favorite part is the reflective moment itself. And the fact that you can track if your mood has declined or improved overtime with it" (P11). With this feature, the app was seen as "different to the normal app which people use . . . it's good to have something to talk about when you're listening to a song and see how it makes you feel" (P2).

Need for Personalization

A prominent theme across discussions about appeal and engagement was the need for personalization. For example, P2 suggested,

> Maybe even having a bit of a . . . not a quiz, but something that's individualistic to the person, so a couple of questions being, "Do you usually listen to this kind of genre? Do you work out?" . . . and maybe then somehow having some sort of algorithm that generates like "Oh, here's something we think might be good for you."

Gender Differences

To address Hypothesis 2, a Mann–Whitney nonparametric test was conducted on the median values for AU6 during the test condition for males (*Mdn* = .00, *Range* = 10.70) and females (*Mdn* = .70, *Range* = 13.80). A small significant difference was found, U (N = 20) = 78.00, p = .035, r^2 = .12. A second Mann–Whitney test was conducted on the median score for AU12 for men (*Mdn* = 5.25, *Range* = 14.60) and women (*Mdn* = 4.80, *Range* = 12.40). No significant differences were found; U (N = 20) = 47.00, p = .853, r^2 = .001. Thus, Hypothesis 2 was supported, albeit with a small effect size. Following this, separate Mann–Whitney test were conducted on the survey results for each domain, with gender as the independent variable. The survey responses revealed no significant differences between males and females in relation to engagement or aesthetics (Table 3).

Age Differences

To test Hypothesis 3, Mann–Whitney tests were conducted to compare age groups on AU6, U (N = 20) = 63.5, p = .315, r^2 = .03, and AU12, U (N = 20) = 62.00, p = .393, r^2 = .02. No significant differences were found. Following this, separate Mann–Whitney test were conducted on the survey results for each domain, with age as the independent variable. The survey responses revealed significant results, with more positive responses from the younger age group in engagement and aesthetics (Table 4). Thus, Hypothesis 3 was supported.

Qualitative data also highlighted differences in responses to the app across age groups. Interviews with younger people tended to be more approving of the colors used: "The colors were very nice. They were very uplifting and vibrant" (P17) as well as, "Very appealing to the eye" (P18). However older participants reported feeling that the aesthetics were somewhat childish:

> I think like, it was quite young. For someone who might be going through a problem to use the app that looks like a child app, they might not feel comfortable using it or think it's a reasonable source that's going to give them the information that they need. (P8)

Again, the need for personalization became apparent, with P19 suggesting that perhaps the aesthetic could be customized according to user age:

> Maybe there's a way you can have a setting for teenagers and then a specific setting for adults. For example, a teenager may not feel the same way an adult does and if there are specific features for a teenager, then they can research and say, "Oh, that's what I can use." (P19)

Usability

As seen in Table 2, *Functionality* of the app was rated positively; this domain was rated equal highest alongside perceived effectiveness and provided information. Table 3 further demonstrates that males reported significantly higher functionality than females (p = .010). They reported being capable of using the app intuitively (n = 5, 50%), whereas females were more likely to feel that the app was only usable after some time and effort (n = 6, 60%). Age differences in functionality were also apparent (Table 4), with the younger age group giving significantly higher ratings for this domain than older users ($p < .001$). Most older participants believed the app to be slow at times and requiring improvement (n = 7, 70%), whereas all participants in the younger age group reported that despite being slow at times, the app worked overall.

Qualitative data confirmed that some improvement in ease of use is warranted. Many participants expressed some confusion about how to use the app during think-aloud sessions, with verbalizations such as, "I do not know . . . I do not know how to do this" (P9). As another participant stated: "You really do not know where to go from the first page. It's kind of a bit frustrating because I do not really know how to use it or what to use it for" (P8). Similarly, another said, "I just got a bit, um, confused with how many . . . the sections. There was a lot of questions and I didn't know which one was which because all on different pages and . . . yeah there's just a lot of questions" (P3).

Although the app did contain a user guide with instructions of how to navigate it, users expressed feeling bothered by the fact that it was "tucked away within the settings" (P1). Participants suggested that "It might be beneficial to have it on the homepage. Because you know, that's the first thing you see. You might want to see the guide as soon as you open the app" (P15).

Table 3
Descriptive Statistics and Mann–Whitney test Scores for Each Survey Domain, Split by Gender

	Gender					
	Male		Female			
Survey domain	*N*	*Mdn*	*N*	*Mdn*	*U*	*p*
Engagement	10	4	10	3	0.64	.548
Functionality	10	4.5	10	3	7.91	.010
Aesthetics	10	3.5	10	3	0.27	.796
Information	10	4	10[a]	3.5	6.18	.024
Perceived effectiveness	10	4	10	4	2.59	.159

[a] For item 14, within the *Information* domain, $N = 9$ as a single response of "N/A" was omitted from analyses.

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Discussion

This study aimed to evaluate the usability and appeal of a first iteration of *MoodyTunes,* a newly developed music-based mental health app. While exploring general impressions relating to functionality, engagement, aesthetics, information and perceived effectiveness of the app, the study also hypothesized that users would display positive emotions while using the app, particularly females and those in a younger age group. The first and third hypotheses were supported with FaceReader analysis suggesting the presence of more positive emotions in participants while using the app than in comparison to a baseline period, and survey data suggesting that feedback was particularly positive in young people. The general findings in relation to a positive response to the app were backed up by a positive overall star rating of the app, and positive ratings for functionality and perceived effectiveness.

However, less support was found for gender differences as suggested by the second hypothesis. FaceReader analysis revealed that female users displayed more positive facial expressions than males during app usage compared to a baseline period. However, the effect size was small and these findings were not replicated in the survey results, which found no significant differences between genders on ratings of engagement and aesthetic appeal. Although this did not support our hypothesis, this was an encouraging finding given that previous research has indicated that males may be less inclined to engage with mental health apps in general (Hoek et al., 2012; Kenny et al., 2016) and that women may be inclined to perceive mental health interventions as more helpful than men (Whittaker et al., 2012). Indeed, finding ways to engage male users in learning about mental health provides particular challenges for mental health professionals (Affleck et al., 2018). However, in the current study, perceived effectiveness of the app was rated equally by both genders. Men in the current study also appeared to find the app more intuitive and easier to use than women. The slight difference found in facial expressions between men and women while using the app could also be tentatively attributed to the social aspect of the study environment and a greater interest by female participants in interacting with the researcher in a positive way.

Although there were no significant differences in facial indicators of positive emotions between age groups, survey and qualitative data revealed that people in the younger age group did indeed find the app more appealing and engaging than older participants. However, overall and particularly in older youths, *MoodyTunes* lacked in aesthetic appeal. The aesthetics of an app is often linked to its quality, which is frequently found to be influenced by how "clean" the design of an app is (Bhandari et al., 2019). Colors also influence users' impressions of an app, with blue having been found in past studies to elicit negative responses such as sadness (Takahashi & Kawabata, 2018) and depression (Hanada, 2018). Lighter colors such as white, pink, yellow and green have been found to evoke positive responses in previous studies (Takahashi & Kawabata, 2018), as confirmed by participant comments in the current study. As the "look-and-feel" create a user's first impression of an app (Porat & Tractinsky, 2012), this is a crucial aspect that will need to be improved in future iterations of *MoodyTunes*. As suggested by users in this study, personalization of the look-and-feel may be a solution to this problem, in order to accommodate both a younger aesthetic and a need for greater sophistication in older users.

Although users generally rated the functionality domain positively, qualitative data (particularly from female and older participants) revealed that ease of use was an area in which there was

Table 4
Descriptive Statistics and Mann-Whitney Test Scores for Each Survey Domain, Split by Age

	Age group (years)					
	12–17		18–25			
Survey domain	*N*	*Mdn*	*N*	*Mdn*	*U*	*p*
Engagement	10	4	10	3	31.4	<.001
Functionality	10	5	10	3	14.07	<.001
Aesthetics	10	4	10	3	21.70	<.001
Information	10	4	10[a]	4	8.70	.007
Perceived effectiveness	10	4	10	3	13.12	.001

[a] For item 14, within the *Information* domain, $N = 9$ as a single response of "N/A" was omitted from analyses.

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still room for improvement. This may have been due to a general unfamiliarity with Android devices (Sarkar et al., 2016), as the prescreener of the current study indicated that almost all participants (n = 18, 90%) owned iPhones. First-time app users generally also report difficulty in setting up a new app, typically requiring help and time to adapt (Crane et al., 2017; Torous et al., 2018). As in previous usability studies, the greater ease of use reported among younger participants may be attributed to greater comfort and familiarity with apps among this age range (Fuller-Tyszkiewicz et al., 2018). However, according to the Technology Acceptance model people will either accept or reject technology based on how simple it is to use (Crane et al., 2017). Functionality issues, reported by older participants, may generate the impression that an app cannot be relied upon (Crane et al., 2017). Findings from past studies suggest that by solving ease of use concerns, the relationship between a user and an app may be strengthened and result in more significant interventions (Lambert & Barley, 2001). Thus, this suggests that the user instructions that are presented upon first downloading an app and the overall app design are both essential factors that could be improved to increase usability.

The three most highly scored domains in the survey data by all participants were the functionality, provided information, and perceived effectiveness of the app, which all scored equal ratings. Based on this, alongside the positive ratings for the subjective quality category, we can infer that the majority of participants believed the app to have potential regarding mental health literacy and mood regulation strategies. This finding contrasted those from prior research, in which mental health apps tended to obtain the lowest ratings for the app's likelihood to change behavior and motivations to address mood (Rickard et al., 2016). Younger participants also rated each app domain as significantly higher than older participants, consistent with previous research, which suggested this type of tool is more appropriately targeted to younger adolescents (Rickard et al., 2016; Whittaker et al., 2012).

In addition, users valued the accessible professional support *MoodyTunes* offered. This demonstrates that although young people may be reluctant to seek professional help, when prompted to do so through a means that they are able to relate to, they may be more willing to seek out others that could assist them. However, previous studies have found that most mental health apps do not directly connect users with help-seeking options, particularly professional crisis support (Larsen et al., 2016). Thus, it is vital to make sure that resources for obtaining professional support via *MoodyTunes* are up-to-date and relevant for all users.

Implications and Limitations

To our knowledge, the current study was the first of its kind to utilize FaceReader to analyze the facial expressions of participants while using a mental health app, although previous studies have recommended the use of automated evaluation tools in such assessments (Zapata, Fernández-Alemán, Idri, & Toval, 2015). The study also demonstrates the potential of music to engage young people in learning about mental health and emotion regulation, further complementing the limited mental health research concerning males—who may be aversive to participating in such studies (Dowling & Rickwood, 2013; Signorella & Vegega, 1984)—and is strengthened by the inclusion of a diverse range of adolescent age groups (Coughlan et al., 2013). Results suggest that young people display some enthusiasm for the concept of music as a tool for improving well-being. Thus, music can be a useful doorway to conversations with young people about mental health, particularly those who may be more reluctant to seek professional support (Hense et al., 2018). *MoodyTunes* may therefore be a useful tool for music therapists and other health practitioners alike in future iterations.

However, future studies must assess whether these perceptions translate into practical changes and sustained improvements to mental health when using future iterations of the app (Rice et al., 2014). The present study was further limited by researcher presence and participant knowledge that they were being recorded during the usability study, which may have impacted responses and behavior (Borycki et al., 2015), and the fact that *MoodyTunes* was only available on an Android device, which most users were not familiar with. Research also shows that younger age groups may be reluctant to voice their opinions in such intimate settings (Peterson-Sweeney, 2005), and so future related work may benefit from altered data collection environments. Furthermore study participants were not given the opportunity here to check interview transcripts and results.

Future app developers should conduct longitudinal studies exploring participants use of the app over an extended period in an endeavor to gain a more accurate understanding of usability and effectiveness, and with apps being available on multiple types of devices (Crane et al., 2017). These findings inform a key challenge for app developers to enhance usability and engagement in order to ensure prolonged use inclusive of all users.

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Received July 13, 2021
Revision received February 8, 2022
Accepted February 14, 2022 ■

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