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To cite this article: Lynnette Nathalie Lyzwinski, Liam Caffery, Matthew Bambling & Sisira Edirippulige (2018) University Students' Perspectives on Mindfulness and mHealth: A Qualitative Exploratory Study, *American Journal of Health Education*, 49:6, 341-353, DOI: [10.1080/19325037.2018.1502701](https://doi.org/10.1080/19325037.2018.1502701)

To link to this article: <https://doi.org/10.1080/19325037.2018.1502701>



Published online: 10 Sep 2018.



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University Students' Perspectives on Mindfulness and mHealth: A Qualitative Exploratory Study

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ABSTRACT

Background: Mindfulness can help college students with key challenges they face relating to weight gain and stress-induced emotional eating and binge eating. Little is presently known about the extent to which students are aware of mindfulness, their conceptualization and understanding of it, and the barriers as well as the facilitators of mindfulness on campus. Understanding the barriers and facilitators may also inform future Health Education and promotions campaigns. Additionally, promoting mindfulness through mHealth is a novel and accessible intervention medium. Though there have been qualitative studies on mHealth for weight loss, there has not been a study on mHealth for weight loss using mindfulness that has explored student perspectives on mHealth for promoting mindfulness. **Purpose and Methods:** An exploratory pilot study with a participatory design using qualitative methods was undertaken at the St. Lucia campus at the University of Queensland in March 2017. Data were analyzed with the assistance of NVivo software. **Results:** Participants identified a number of barriers to a mindful lifestyle: social, cultural, knowledge, and time management related. Environmental barriers included the food environment because it promoted a fast food mentality over slow, mindful eating. The mindfulness-based sample text messages were positively received by students. Students preferred messages with practical tips about how to be mindful and how to integrate mindful reflection on both one's body and one's environment while on campus. Students preferred a theoretical future student-centered mindfulness app that had the following design features: a simple design interface, a focus on education/practical tips, and real-life practical exercises. Social media should be avoided. **Discussion:** This study is important because it identified a number of potential barriers to and facilitators of mindfulness in students that should ideally be targeted by maximizing the facilitators and by aiming to minimize potential roadblocks. Mindfulness can be made more accessible to students by targeting educational, social, and environmental barriers. Future mHealth studies may consider integrating mindfulness-based text messages in their interventions for weight and stress because this is a novel feature that appears to be acceptable for students. **Translation to Health Education Practice:** Health Educators should aim to increase knowledge dissemination efforts and improve the campus social and built environments to promote mindfulness by making it accessible. Sending tailored inspirational mindfulness-based, educational text messages that have a student context is also a good idea.

ARTICLE HISTORY

Received 28 April 2018
Accepted 5 July 2018

Background

University students are a group who struggle with weight management issues that develop during their studies, termed the “Freshman 15.”^{1,2} Key issues involved with this weight gain phenomenon include stress and poor lifestyle habits (diet and exercise).^{1–3} Research suggests that when individuals experience stress, the relationship with the food–body reward pathway is altered and high-calorie food with a low nutritional value (junk food) creates an addictive reward system.^{1,2,4,5} Therefore, students are at risk for engaging in an unhealthy lifestyle when under stress,^{6–11} including binge eating before exams, cravings for junk food,

and consuming fast food.^{6–11} Given this link, there is a need to prevent students from responding to stressors in maladaptive ways and to help with forming healthy habits throughout adulthood.

In recent years, mindfulness has emerged as a health promotion strategy to help individuals with various health issues.^{12–14} Mindfulness is a form of present moment awareness meditation that requires tuning into one's present reality and not deflecting one's thoughts to past or future concerns.^{15,16} Research indicates that mindfulness assists with stress management and weight loss.^{12–14} Mindfulness holds promise for

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university students because it targets key health challenges they experience during their studies, including stress, weight-related behaviors (eg, binge eating and emotional eating), and weight gain,^{12–14} according to recent reviews.

A recent systematic review found positive relationships between mindfulness and healthy weight-related behaviors in university students.¹⁷ Thus, promoting mindfulness in students is desirable given that it assists with managing weight,^{13,14} because being overweight is a risk factor for premature mortality and chronic diseases such as cardiovascular disease and diabetes.¹⁸

However, few of these studies involved a mindfulness educational program for students with the exception of 2 studies that found that teaching mindful eating as a course credit increased overall levels of mindful eating in this population,¹⁹ but improvements were not significant in the other study in a review.^{17,20} Little is presently known about how university students understand mindfulness and whether there are any particular facilitators or barriers to promoting mindfulness practice in this population. In order to develop targeted Health Education and promotion strategies on campus that assist students with being mindful and eating mindfully, there is a need to first gain deeper insight into students' perspectives on mindfulness. Qualitative research may provide insightful information about personal perspectives and experiences.²¹

Additionally, research indicates that students do not typically seek health service assistance for their issues and, when they do, counseling services are limited, often with waiting lists.²² Moreover, weight loss counseling services are more scarce in the university setting.²³

One platform for weight loss is mHealth.²⁴ mHealth refers to mobile health care, which has the benefit of being able to promote health, educate, and allow for self-monitoring of health at any time and place.²⁵ Delivering a mindfulness intervention via mHealth is appealing because it provides students with instant support and access to assistance. This is particularly convenient for students because they have busy class schedules and hence finding the time for face-to-face interventions may be a challenge. A meta-analysis and review of mHealth found that it is an effective medium and health promotion tool for weight loss.²⁴

Furthermore, though mHealth interventions for weight management have explored user perceptions and preferences for mHealth,²⁴ there has not been a study on mHealth and mindfulness for weight management that has explored student preferences. It is presently unknown whether mindfulness taught via

mHealth is acceptable for students and what ideal mHealth features are preferred by this population.

In a recent review of qualitative mHealth studies for weight management, important factors such as message timing; age-appropriate, relevant message construction and tone; and message content played vital roles.²⁶ Thus, it is important to better understand how students perceive mindfulness-based text messages in order to construct messages in future Health Education campaigns that are preferred by users as well as to minimize perceived barriers. To date, there no qualitative study has explored consumer perspectives on mHealth and mindfulness including mindfulness-based SMS or text messaging. Additionally, a past review found that few mindfulness apps in the app store are appealing in terms of design and user engagement.²⁷ It is equally important to explore students' personal theoretical preferences in a potential future mindfulness app that is student tailored, which includes a consideration of theoretical design preferences and any potential barriers and facilitators that may influence use.

Purpose

The purpose of this qualitative participatory pilot study was to

- (1) Gain insight into students' perspectives on mindfulness, including knowledge dissemination, facilitators, and barriers on and off campus, that may inform health promotion and education campaigns.
- (2) Gain insight into mindfulness-based mHealth intervention feature preferences, with an emphasis on mindfulness-based text message preferences by sending specially formulated sample text messages using a participatory design.
- (3) Explore theoretical app design preferences and potential barriers in a potential future student-centered mindfulness app.

Methods

Participants and setting

We undertook a qualitative exploratory study with university students from the University of Queensland (UQ), St. Lucia campus, in March 2017 at the School of Rehabilitation Sciences.

Recruitment and eligibility

UQ students were eligible to participate if they were 18 years of age or older. Recruitment strategies included handing out posters and flyers on campus, in particular during market week. They also included advertising from the Centre for Online Health's website. Students received a coffee voucher for participating. Purposive sampling was undertaken, whereby we aimed to recruit students with some prior experience with health apps or some idea of what mindfulness is.

The study involved a participatory pilot design with participants providing both their perceptions in a focus group discussion and written emailed feedback on sample mindfulness-based text messages that were constructed in response to their earlier feedback (see Figure 1). The study was approved by the UQ Human Ethics Research Committee A (approval number 2016001866). Participants were informed of the purpose of the study and that there were no right or wrong answers. They were also given an information sheet. Written informed consent was provided by the participants before enrolling in the study.

The focus group was facilitated by the first author. A discussion guide created by the research team was used to guide the group discussion. The discussion guide was centered around two main discussion topic sessions. The first discussion topic had questions on overall knowledge translation as well as barriers and facilitators of mindfulness on and off campus. The second discussion section topic focused on mHealth intervention feature preferences including mindfulness-based text

message preferences and some design preferences for a theoretical student-centered mindfulness app as well as a consideration of potential barriers. The guide allowed for further probing around the key ideas and questions.

One week after completing the focus group, students were sent sample mindfulness-based text messages based on their focus group feedback in Table 1. They were asked to provide their written feedback regarding the text messages by email. Those who did not reply were contacted by phone. They were instructed to discuss their message perceptions, preferences, and any improvements they would like to see in future mindfulness-based messages tailored to students.

The qualitative in-person interview was digitally recorded using a Mac laptop as well as with a handheld Philips voice recorder. The focus group lasted for an hour until participant responses reached saturation upon confirmation that they had no further thoughts or comments to add. Oral recordings were then transcribed. Additionally, written feedback from emails was combined for analysis. Individual participants were given a code for confidentiality and hence the data were anonymous. NVivo software was used to assist with the data analysis by grouping the data into key major categories and a content analysis was undertaken of part A and part B transcripts. L.L. undertook the coding for the key categorized thematic topics, which were identified by similar ideas raised and key phrases used by participants. The content analysis involved identifying key

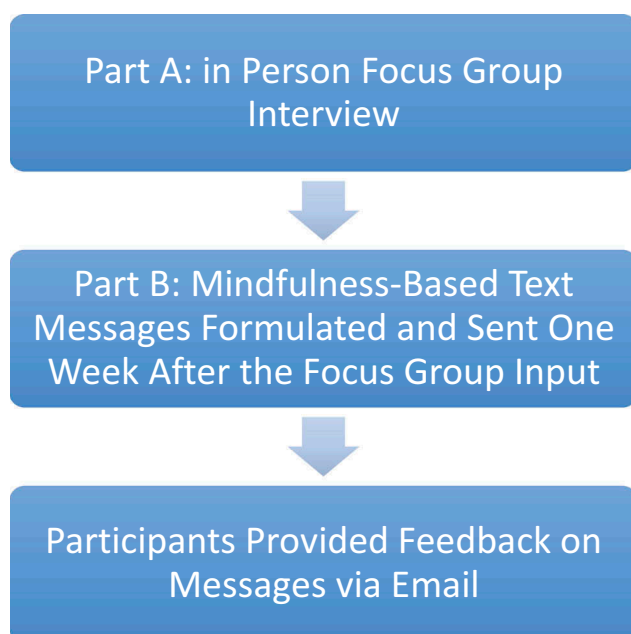


Figure 1. Qualitative study process.

Table 1. Mindfulness-based text messages.

Message theme	Description
Mindful eating/diet/physical activity Knowledge	A mindfully aware student is aware of the dietary and physical activity guidelines
Mindful eating fact	Mindful eating involves focusing on your visual, olfactory, sensory, salivary, and auditory senses by focusing on what the food tastes like, feels like, smells like, looks like, and even sounds like. This can be done throughout the day at breakfast, lunch, and dinner or when you experience a craving
Present moment awareness tip 1	A mindful student practices mindfulness by really seeing, hearing, feeling, and smelling the environment around him or her, including the natural campus landscape
Present moment awareness tip 2	Having cues throughout the day can help you with being mindful. Your peers identified the lake as being a mindful moment spot
Present moment awareness tip 3	Taking photos may help with bringing present moment awareness to what is inspirational. It could be someone's smile or a photo of nature
Mindful body fact	Being aware of your body including what it feels like can help with bringing mindfulness awareness to it. You have 206 bones in your body. Your foot alone with your ankle has 26 bones and more than 100 muscles

ideas based on student preferences and perceptions from their feedback in the transcribed data from the verbal interviews and compiled email responses from the second part of the study. Key categorized themes were created on the basis of common topics, phrases, and wording used by students in response to the discussion questions. L.C. and M.B. validated the key themes from the data independently alongside L.L.

Results

Eight university students participated in the qualitative participatory design study. The sample was predominantly female and Caucasian (75%). Several themes and sub-themes emerged relating to mindfulness knowledge translation, barriers to being mindful on campus, facilitators of mindfulness in the student population, and preferred features that students would like in mHealth mindfulness-based interventions in tandem with potential barriers to avoid.

Part A—Focus groups

Theme 1: Being mindful on and off campus is rare

A key theme that emerged when students reflected on what mindfulness meant to them was that they were very rarely mindful on and off campus. These included things such as not savoring the moment; as one student put it, "... when you spend so much time thinking about dates that are ahead of you, when assignments are due, when exams are, when you are going out this weekend, when you have work, when you have all this stuff it is a rare quality to appreciate what is happening in that instance" (R5). Another found that students do not pay attention to their environment, arguing that "it's kind of a common occurrence that people just go by their day like a haze it's like I was doing this, then I did this. They're not really like noticing." (R3). Another found that technology can make students less mindful of their surroundings, arguing, "I think technology makes us less mindful. I think I check the weather zone a lot more than when I look out the window" (R6). Being mindful during social scenes like parties was also raised by one respondent as not being a common occurrence (R2).

Theme 2: Mindfulness barriers on campus are related to social awareness and support

Mindfulness knowledge translation is mixed and perceived difficulty misperceptions limit accessibility

Knowledge translation by Health Educators on campus was also not reaching all students because there was inconsistency in terms of the extent of knowledge of mindfulness

among students, with a few being uncertain and one finding that undergraduates are not very aware: "It's more common among university students than high school students, but I don't think they are that aware. Obviously stuff like yoga and Pilates come to the forefront but the philosophy perhaps doesn't come with it so much as the exercise" (R5). Greater awareness of mindfulness among grads than undergraduates was also raised, with graduate students being more educated about or aware of mindfulness (R1, R8). One respondent also found that the UQ student handbook was not being used or read thoroughly by students: "The handbook is useful but not compulsory to every student. The vast majority of undergrads would not have heard about it or been aware of what mindfulness is even if the university is trying to push it" (R5). Another found that even if there have been efforts to raise awareness, it is not seeping through thoroughly enough to students: "Maybe it's in the handbook but maybe just not explicitly not given to us kind of a thing" (R2). Another student was uncertain how much students retain from mindfulness educational awareness efforts (R8). One participant raised a point that students are not aware of the benefits of mindfulness beyond stress, with background agreement among the participants: "Many of us know about the reducing stress part of meditation but I don't think there are so many thinking about how it's related to food" (R2).

Additionally, the perceived difficulty of mindfulness was seen as a barrier. One student stressed that lack of clear guidance was a barrier, arguing that "... currently if you want to be mindful maybe look online, maybe ask someone. Maybe you will go to a booklet" (R5). Some students advised educating students about mindfulness in a simple way, by making it seem accessible to everyone and not too complicated. For example, one participant found that "... if you present it like almost casually, almost peacefully, almost laid back, they will see that. They will think wow I want to be like that ... but if you present it like, you have to be mindful, then it's going to stress them out even more" (R1). Another argued that mindfulness should be explained in a simple way and accessible way, stating, "Maybe make it seem easy. Often it is described so difficult and so yeah about theories and stuff" (R7). Another recommended that there should be a personal anecdote by telling students what a difference it has personally made (R2).

Social and cultural barriers to mindfulness among students

Students felt that social and cultural factors were major barriers. The social and cultural barriers related mostly to a lack of recognition of mindfulness in the student culture and nonexistent peer norms to practice mindfulness. Thus, students who were interested in

mindfulness did so outside of the accepted student cultural expectations, leading to feelings of potential noninclusion or isolation with the practice.

One participant found

I feel like barriers are kinda social in a sense. ... There is no one like saying hey dude you have to be more mindful calm down. I mean it's not like common, you are not expected to go by your day like mindfully even if it is like more beneficial or productive. So I think it's about like not having that culture around mindfulness that prevents it from happening. (R3)

Another found that in social settings students do not think about being mindful: "If you are going out, then I don't know you are probably not going to be thinking too much about what you will be taking in and drinking. Especially if there are so many parties and stuff" (R2).

Students offered potential solutions for addressing the social and cultural barriers. For example, one found that taking part in a group mindfulness session would be helpful: "But if you feel you are part of a group like a mindfulness group session, that's probably more inviting and removes a social barrier" (R5). Another found that getting as many students involved in mindfulness practice would reduce these barriers: "The big barrier is the cultural barrier. You just can't radically change your culture. But the more people that are on board with you, then the more I guess you create this mini culture within this bigger culture. ..." (R1).

Theme 3: Mindfulness facilitators among students: The campus environment can be changed to promote mindfulness

The food environment

Two students felt that the food environment on campus could be changed to promote healthier food and mindful eating. For example, one felt that a shift from the fast food mentality to slow eating on campus is needed, arguing that

... the way a sushi place or subway is built around the idea of convenience. The second you step in there it is pretty fast. They are trying to make it quickly, they are selling you the idea you need to eat this fast. So more food establishments that let you sit down, enjoy it, and take your time. You would look a bit weird licking a raisin lovingly on campus. If food places facilitate that it would be good. (R5)

A third respondent felt that fast food should offer healthy food from the earth, which would help students reflect on where it came from, hence facilitating mindful eating (R1).

Thus, changing the food environment in order to support slow mindful eating and promote one's

connection with food by selling healthy unprocessed food seems to be important for mindfulness promotion.

The built environment

Additionally, the built environment on campus was identified as being an important facilitator of mindfulness, namely, through environmental cues and spaces for creativity. Cues on campus included having a blackboard or message board with inspirational mindfulness messages, inspirational drawings, and signs. For example, three students (R3, R4, R6) recommended reminding themselves to be mindful and breathe. Two suggested that this could be achieved with such as a sign or message board that reminds students to breathe.

Having a creative outlet on campus was also seen as being good for instilling mindfulness in students (R1). For example, one student argued that

adult coloring books are taking off. So say there is a spot on campus. I don't know like a chalk board and just show up and doodle on it. Or each day it is different. Say someone who is good at draws an outline and you color in a section or something that can be kinda cool and you can link that up. Or you can make it digital as well. ... Maybe everyone puts in a jigsaw puzzle. ... (R6)

Theme 4: Theoretical mindfulness app design preferences: Easy to use yet filled with rich and engaging content

Simplicity in design and content: Less is more

Several students preferred a mindfulness app that was easy to follow and navigate. Having simple, clear, and uncomplicated information was preferred. Students felt that the app should have minimal buttons, such as 4 buttons on the home screen.

For example, one respondent wanted an app that was simple: "[It] can be counterintuitive if a mindfulness app is difficult to navigate. ... If the app itself is showing you to be simple, clean, and efficient it's much easier to get invested in being simple, clean, and efficient yourself if the app, if the mechanics of it are there" (R5).

Another respondent argued that pop-ups take away from being mindful, "because I think the least mindful thing in the world is when an add pops up when you are trying to do stuff" (R6).

They also thought that the app should encourage students to search for mindfulness in their real lives through inspiration rather than making the app a source of inspiration (eg, preferences for searching for beautiful places over having the app incorporate excess

music and photos). One respondent felt that the app should have few features and should make users search for mindfulness in their own lives: “I think the app should almost in a way have very little features. ... It should force you to be where you are so almost less is more” (R1).

Facts/knowledge based: Importance of education

Students also preferred a knowledge-based app. This included education about the benefits of mindfulness on student health. For example, one respondent felt that education in the mindfulness app was the most important feature it should focus on: “I think just education. I think a lot of this comes down to people just don’t know what is. They don’t know how it can benefit them. ... Basically explaining cause if everyone knew how important it was like truly knew I feel they would do it, they would prioritize it” (R1).

Additionally, participants wanted practical facts about one’s body that help students reflect mindfully and tune in with their bodies:

I think I would like it if my mindfulness app gave me facts. For example, so you know maybe it will say you’ve got 45 bones in each foot. Try and like just think about your foot for a little while. Focus on all those bones. You know, try and relax each muscle in your foot. Or you’ve got 700 million hairs in your arm kind of a thing. I don’t know, like a daily fact would be worth it. I’d open my app for that. I’ll be doing meditation or whatever it was. (R6)

Furthermore, two respondents expressed a desire for practical nutritional facts about sodium in order to mindfully reflect on this when eating (R6, R7).

Entertainment: Practical real-life exercises and rewards

A couple of participants expressed a preference for practical real-life mindfulness exercises in the real-world student setting. For example, one participant preferred being given real-life mindfulness exercises to reflect on rather than being told about the benefits of mindfulness (R3). Another respondent thought that the app should not have images or sounds that help with mindfulness and instead students should look for these things within their present realities context: “But then no, you want them to look around. Maybe something like a scavenger hunt. Like ok here is this picture go look around” (R1).

Rewards were also brought up as a desired feature by two students. For example, “When you are doing

practice, can encourage the user of the app because who doesn’t like to be encouraged or praise? You’ve done well, continue, or something like that” (R4).

App sound preferences

Two students thought that repetitive slow sounds in the app could help with practicing mindfulness as well as yoga (R1, R3). One participant felt that there should be a musical section where one could identify different instruments (R1). Three participants expressed a desire for soothing sounds of nature (R5, R7, R8), and one participant preferred seeing nature over listening to sounds of nature (R2).

App imagery preferences

A few students liked the idea of having an app with photo storage space of mindful moments. One participant thought that it should be one of the 4 things in the app (R1). Photos were seen as being sources of inspiration by one student: “Photos care cool. You can bring photos that remind you of happy times” (R5). Two participants preferred integrating familiar photos: “I would feel more connected to that ’cause I’ve been there, I worked there, I know that or whatever. And so that’s why the lake like you said is a good one” (R6).

A few felt that the photos should be optional, however, and not tasks or assignments to complicate the app (R2, R5). One felt that it was better for it to be phrased as a suggestion over a task and one felt that it would possibly stress students out (R5).

Some calming images that were brought up included tropical fish, underwater, the forest, sunsets, and trees. One student felt that images outside of university would be good: “Maybe on the beach. We spend so much time in libraries and stuff like that” (R8). There was no clear color preference besides the earlier sky discussion. Some possible colors for the app interface design included green or mellow-yellow. The sky was brought up as a symbol that would stimulate calm and mindfulness in students: “Personally I like taking pictures of the sky, it calms me down” (R4). Another student felt that it would be a neat idea to take photos of the sky: “If you went to the same spot everyday took a photo of the sky. Store it in an album that would be an interesting album to have maybe” (R6). One participant thought that the app screen should look like the sky: “Just have a blue screen, it’s my colour, reminds me of the sky” (R5).

Theme 5: There are potential barriers in a student mindfulness app that should be minimized

Psychological failure/fear of failing

The need to reduce the fear of failing was raised by a few participants, including expectations about being completely well after practicing mindfulness. For instance, one student noted, “I think they should take the pressure off. Maybe if it would say something but like you don’t necessarily have to feel happy or 100% better after this” (R2). Another respondent argued that “the reality is no matter how mindful we are still going to be stressed. Making them feel they are not failing because they are not transformed by this in 10 days. It’s like a process” (R1). Students felt that focusing on the benefits of practicing mindfulness rather than focusing on what a lack of mindfulness and high stress can do to students would help reduce this barrier. For example, one student thought that the app should not scare people about stress: “Maybe don’t scare them with stress but still give them a reason why you should do it” (R7). Another felt that talking about the damaging effects of stress may create more stress: “I’m always stressed about how stressed I am. Don’t stress out because all this bad stuff will happen to you is stressful. Like that is such a stressful thing to read” (R6).

Timing

Time was identified as barrier to using the mindfulness app and to practicing mindfulness in general among students (R6, R2, R1, R8, R5). For example, “Some wellness programs might tell you that you should definitely do ten minutes a day, you wonder how will I have ten minutes ...” (R2). Students agreed that the exercises should be short. For example, one student felt that the exercises should be a few minutes: “Like if the shortest you do it is for 10–15 minutes it’s really easy not to do. If the shortest you can do it is just a minute, it’s more likely you will actually do it” (R8). Another student thought that it was good to work your way up with practicing mindfulness using the app by starting off doing it for just a few minutes and then increasing the time (R5). Another respondent felt that students could decide for themselves how much time they put in because some mindfulness activities could be short or long depending on preferences: “Like cool activities like scavenger hunt. You can spend a lot of time looking about or a very little. Or thinking about bone structure. You can spend a lot of time thinking about your bones wow or just a little” (R1).

There was no clear agreement among students about what the ideal mindfulness message timing should be and preferences were mixed in terms of the frequency of and time of the day for messages to be sent.

Technological distractions

Technological distractions were identified as being potential barriers or hindrances in a future mindfulness app by 2 participants, including the phone ringing (R1), too many sounds or images in the app (R1), as well as too many adds, pop-ups, and buzz words (R6).

Tracking of mindfulness and sharing on social media: May not be ideal for all

Two students considered self-monitoring features as possibilities for a mindfulness app. One was not sure whether it should be implemented or not: “This is kind of a slippery slope ’cause you don’t want it to be about fulfilling a quota. ... You don’t want it to be like oh I’ve got to do my ten minutes of mindfulness every day” (R1).

Another student thought it would be a good idea to time meditation practice as a way of self-monitoring: “You can get it to time you to be still for example. So you can be like alright iPhone I’ve started being still right now. And then you go I twitched or looked out the window or whatever. Today you were still for four minutes and yesterday it was only three and a half so good work” (R6).

The key point that mindfulness practice should not be shared via social media but only with close ones was raised by 3 participants. Students felt that their practice was something more personal that one should share with loved ones and not larger social circles: “It’s the kind of thing you tell your best friend or mom and get them to check in” (R6). Another student suggested having the option of adding friends without making it compulsory and another noted that it could somehow help with spreading awareness of mindfulness (R8). Another student felt that it should be private altogether:

There are only certain people you can celebrate I wrapped up 15 minutes of mindfulness. But I think for the average social circle that’s probably not going to be a huge part of it. To a certain extent maybe you want your mindfulness relationship to be private and you don’t want to broadcast it to everyone and you want time exclusively for yourself. (R5)

Cost

If mindfulness education is promoted through a program, cost was identified as a barrier by 2 students. One student found that current apps are too expensive: “I think the app should be free. Headspace is really expensive. It’s a \$130 a year I think it should be free” (R2).

Another respondent agreed: “I’m not going to spend that much money on an app” (R8).

Theme 6: Mindfulness-based message preferences: Students prefer meaningful and personal messages

Inspirational and encouraging messages

Inspirational messages were identified as being important for a few participants. For example, one participant felt that it should check in on you: “Just saying hi, just checking in on you, making sure you are checking in on yourself kind of thing” and another found that

like have you ever sent a message to a friend, just like hey hope you’re having a great day I’m thinking about you. You’re finding that’s so awesome. Well if an app just like did that it would be amazing and some people don’t have that. And it doesn’t have to be everyday. It should be set on a random setting. It’s like maybe get it once every three days. (R1)

Mindfulness messages that were encouraging and motivational were also desired by students. One participant felt that these encouraging texts would set you for the day (R7). Motivational text messages were also identified as being useful for promoting mindfulness: “Having a friend kind of send you a message or something. Oh this person cares about me and wants me to pay attention this this moment. . . .” (R3).

Personally tailored

Personal tailoring of the mindfulness messages was preferred. One participant wanted the messages to be custom or for the student to set the messages him- or herself (R3). Another student desired to have mindfulness messages that would be tailored to her binge-eating schedule:

I would quite appreciate my app telling me at like 10:30 pm at night not to binge eat like sweet food just go to bed. . . . If your app knows you eat breakfast at 7:30 maybe it could say at 8 am hope you had a healthy breakfast and you are now digesting it. Hope you hare ready for a great day. Or after dinner or like mid afternoon. Time for an afternoon snack don’t go to the vending machine. (R6)

Two participants wanted the app to be tailored to their daily schedule. Another thought that the app should be set to remind them to be mindful or to take a mindful break: “It would be nice if the app had something you could use while you were reading for very long hours. Like I use an alarm and I stop reading every 45 minutes to just take a stretch or push-ups or whatever just stop reading. They could be mindful exercises” (R7).

Preference for text messages over push notifications

Students preferred mindfulness text messages over push notifications in principle. They thought that text messages were more personal for them rather than finding out that their app was automatically messaging them (R1, R5, R8). For example, one student felt that it would be exciting: “I would get way too excited if I would get a text message” (R5).

Part B—Email follow-up

Theme 1: The sample mindfulness-based text messages are positively perceived but need to be improved by making them more student friendly with relevant practical tips

Overall, participants liked receiving the mindfulness-based text messages. Some suggestions were given to improve them, including their phrasing in order to make them shorter and more precise.

Message tone and phrasing

A careful consideration of message phrasing and tone was brought up as being important. Two students felt that students may not like to be told what to do, so the messages should be adequately phrased; for example, “Part of me wants to suggest that some of them could be a little more direct, but some students don’t like being told what to do, and as I read them over, I actually like that they just give hints that the reader can just choose to follow or not given the situation” (R3). Another student felt that the messages should not have an institutional authoritarian tone like the guidelines message: “‘Dietary and physical activity guidelines’ sounds like something boring and institutional that people do just because they love to follow rules. We respond better to things that will clearly benefit us and that we feel we have sought out ourselves” (R6). One student found that the messages could have a friendlier tone (R4).

Fact-based mindfulness messages about the body are a good idea

A fact-based mindfulness message about one’s body was sent to students as a sample because it was something the participants expressed a desire for during the focus group. A few participants felt that the messages were a good idea and enjoyed them after receiving them. Another respondent asked for more messages that are like this one:

I really like that the fact about the bones that was suggested, which makes me a little more mindful without even giving it too much thought. It would be nice to have more messages like that, ones that give little facts that indirectly get students to be more aware of both their bodies and the world around them. Maybe even facts about the air we breathe or something to get us noticing the people around us. (R3)

Thus, it seems that these types of mindful reflection messages about one's body are a good idea. One student did not like this message because she did not find it to be useful but understood that her peers liked it (R2).

Some offered tips to further improve the message by making it friendlier and being more specific in terms of making the message usable as well as improving the wording. For example, "... Maybe a suggestion about how that knowledge can be used mindfully would be good. Perhaps 'How many different muscles do you think you could flex right now?'" (R1).

Guideline messages need to be specific: Not all students are aware of them

Almost all students did not perceive the general message on being mindfully aware of the dietary or physical activity guidelines to be helpful. They all felt that the message needed to be more specific, including providing indications as to what these guidelines specifically are because not everyone was aware of what the World Health Organization guidelines were. For example "The last one however is a bit/too/vague though. What are the 'dietary and physical activity guidelines?' These vary from student to student, and not all students have an extensive background knowledge on this subject" (R3).

General practical health tips are a good idea

A couple of students liked general health tips and eating tips, such as, "I liked the fact based one and the one about focusing on food." For example, one student expressed a desire for more health facts or practical tips: "It might be better to focus on giving general good tips, like 'filling your plate with colorful foods,' 'chewing x amount of times,' or muscle relaxation exercise that's easy to practice on the go" (R3). Another wanted practical tips for diet, exercise, and mindful eating tips:

I do think eating facts or tips are important. This fact as well was pretty general, but I suppose it is important to share even just the general information (just because it's general doesn't mean it's not useful!). ... But I do like the idea of associating food as fuel for physical activity. Maybe a tip/or fact that addresses it as such would be good. (R1)

Messages on how to practice mindfulness are needed

One student liked how the message on mindful eating explained how it could be practically undertaken. However, she wanted it to be more condensed (R6). Two students felt that the other messages could have better explained how to practice mindfulness such as how a student mindfully hears, smells, and feels on campus (R1). Another student felt that more messages should offer practical advice on how to practice mindfulness like the message on taking photos of mindful moments (R6).

Inspirational images

Because the lake was identified as a source of inspiration during the focus group discussion, students were sent a mindfulness message about it. Overall, the students liked it but offered some suggestions to improve it.

Discussion

This study is significant because it is the first study that has explored how students understand mindfulness and the key barriers and facilitators of mindfulness in students. Gaining a richer insight will help with developing interventions that will aim to reduce these barriers and promote mindfulness in this population. This is also the first study that has explored consumer preferences for mindfulness-based mHealth text messages as well as theoretical design preferences including potential hindrances in a future student-centered mHealth intervention.

There was little evidence of mindfulness behaviors among students in this study. They reported that they rarely took the time out of their day to be mindful. Though there was disagreement as to the extent of mindfulness awareness among students, many felt that knowledge dissemination efforts by the university were not enough because they are not reaching most students. The benefits of mindfulness and simple practice instructions should be presented as something that all students can integrate into their daily lives on and off campus because the literature indicates that mindfulness assists with issues that are pertinent to this population such as weight management, eating behaviors, diet, exercise, and stress.^{10,12-14,20,28-30} These lifestyle-related behaviors should be changed early in young adult's lives given that they are risk factors for chronic diseases.^{18,31,32} Despite the lack of consistent mindfulness awareness, students demonstrated interest in and

an openness to exploring mindfulness practice. There is a clear need for greater mindfulness Health Education and knowledge dissemination for all students and on campus in general.

The key barriers to mindfulness for students are predominantly social and cultural. Most students felt that there is insufficient support from their peers. They worry about group norm issues and feel that they would need to practice it alone, resulting in less motivation. Research on social norms from social theory suggests that in order for young adults to adopt certain behavioral practices, they should be accepted by their peers, which includes both positive and negative behaviors stemming from pressure.³³ Research also suggests that social networks do indeed have an influence on obesity and weight-related health behaviors in adults.³⁴ Furthermore, having a buddy on board may assist with adhering to weight-related behavior change leading to weight loss.³⁵ It would be of research interest to study meditation norms and social influences on meditation practice in young adults.

Other strategies for integrating mindfulness into daily life may include participants sending each other text messages in order to reinforce mindfulness practice. Though there is no research on this specifically relating to mindfulness, mHealth studies have demonstrated that text messages may help change weight-related health behaviors through techniques such as motivating and encouraging the participant.²⁴

Additionally, students can raise awareness of mindfulness by forming a mindfulness student club. They can also find support from outlets such as the yoga or meditation club, for example.

Time and cost were also identified as barriers in a minor subset. This makes sense because cost comes up as a barrier to adopting healthy behaviors in tandem with time being a common obstacle in previous studies.³⁶ It would be anticipated that similar obstacles would be presented with mindful eating. Encouraging students to practice mindfulness and mindful eating for even a few moments and to take a few mindful bites with every meal could be useful. Additionally, offering affordable interventions is necessary because cost was a barrier for participants on a student budget. Mindfulness meditation group classes could be offered during lunchtime or after classes on campus without charge, potentially increasing accessibility.

In terms of environmental barriers, although there has not been a previous study on the practice of mindfulness and the built environment as a facilitator, research on nudging relating to eating behaviors indicates that it may assist with shaping eating behaviors by simple cues such as altering the location of the food

item or size.³⁷ The question is whether we can nudge students to be mindful. Cafes and restaurants on campus may consider integrating a mindful food menu. This could involve healthy food options, with organic and whole foods, as well as information on nutritional content that allows for mindful reflection. It could also involve a menu that has questions to reflect on when eating the food, including identifying the individual flavors and reflecting on the origins of the food. Promoting slow eating in a relaxed setting would also be desirable, such as a move from the fast food take-away mentality.

Given the findings of this focus group, adopting social theory³³ and nudging theory³⁷ in the physical and social campus environments to promote mindfulness practice among college students could provide a useful theoretical base for future studies to investigate.

In terms of theoretical design preferences, the key topics raised by students were that simplicity in the app design interface, a focus on mindfulness education/practical tips, and real-life practical mindfulness exercises are essential. This is in agreement with a previous review on consumer perspectives on mHealth for weight loss.²⁶ However, we did not find that self-monitoring of mindfulness minutes is something that may be appropriate in a future app, though a review of past studies found that users of other health apps for weight loss including diet and exercise desired self-monitoring.²⁶ Nonetheless, they could simply record their general mindfulness practice in a diary.

When considering imagery, blue and the sky were raised as universally calming colors and symbols. Research on color therapy has found that cold colors have a calming effect and that the preferred color in psychological treatment environments is blue or green.³⁸ Thus, it may be preferable to use the color blue as a splash screen in the future app or to integrate images of the sky or ocean as an alternative. A past mHealth weight loss study among youth found that pictures were preferred over messages.³⁹ Thus, imagery may indeed be a useful health promotion tool in mHealth interventions.

When considering barriers, it seems that social media should be avoided. Interestingly, past studies in the mHealth behavioral weight loss field found that participants had mixed feelings about integrating social media as well,^{40–42} as seen in our previous review.²⁶ Additionally, the main psychological barrier of fear of failing to be a good meditator or the pressure of “the stress-free concept” seems to be similar to psychological barriers in past mHealth weight loss studies seen in our previous review relating to fear of failing in some way or another.^{26,43–45} One notable barrier unique to a

potential meditation app relates to technological distractions found in this study, which may not be as important in other health-related apps that do not require concentration and tranquility.

The results from the follow-up indicate that students found mindfulness-based text messages to be acceptable. This is important because these types of messages have not been implemented in past studies. However, there was no clear agreement among students in terms of what the ideal mindfulness-based text message timing and frequency would be. Some students expressed a general desire to practice mindfulness early in the day. Thus, messages could be sent early in the day or perhaps in the evening so that students can review them refreshed the next day. There was agreement, however, that they should not be sent during classroom hours. Thus, future studies should ensure either that the messages are personally tailored to an individual's schedule or that they are sent to everyone before and after the typical 9 AM to 5 PM classroom hours. Our former review of mHealth for weight loss found that there was disagreement across users in different studies regarding ideal timing.^{26,44,46–48}

We also found that some students preferred personally tailored messages, which has been found in our past review on mHealth and weight loss.²⁶ Thus, future mHealth mindfulness-based interventions may consider constructing personally tailored mindfulness-based text messages. Additionally, the fact that students were unaware of the World Health Organization's guidelines means that messages should be more specific yet at the same time ensure that they are not overly institutional.

This study is limited by being a single qualitative exploratory study with a participatory pilot design at one university campus with a mostly female sample. The purposive nature of the study required some previous experience with general health apps and some idea of mindfulness, which limited the pool of interest and eligibility. However, it may be that females are more interested in meditation on campus and have used health apps before. Funding limitations also restricted this to a small pilot participatory study. The interviewer's opinions about mindfulness did not influence the study because the interview guide did not have any right or wrong answers and hence participants openly discussed their own personal viewpoints.

This is the first qualitative participatory pilot study that has examined university students' perspectives on mindfulness, including facilitators and barriers on campus. In summary, this study found that mindfulness is rare among students and that social, academic, and time pressures lead to an unhealthy, mindless lifestyle.

The key barriers to a mindful lifestyle include finding the time; an affordable mindfulness intervention; knowledge, social, and cultural barriers that result in low motivation; and the campus food environment. Students need to be more aware of what mindfulness is, its benefits for weight and stress, and how to practice it.

Second, this is the first study that explored university students' perspectives on mindfulness and mHealth, including mindfulness-based sample text messages and theoretical app design preferences for a future potential app. Some key important things to keep in mind when designing a future mindfulness app intervention is to ensure that the app is simple and easy to use. The content of the text messages should involve education, inspiration, and personal relevance. The content of the mindfulness-based messages should also focus more on making students reflect about their bodies mindfully because this appeared to be desirable. Students also wanted practical health facts and tips in the messages. When sending them fun tips, it is also a good idea to give practical advice about how to practice mindfulness everyday. Barriers to using a mindfulness app can be overcome with short activities that show that mindfulness is easy to do and can be intuitively integrated into daily life. Likewise, the overuse of traditional app features is discouraged.

Translation to Health Education Practice

Health Educators should consider working on improving awareness of mindfulness and better knowledge dissemination among students. This could include clearer guidance in student handbooks and promotional educational material that is easily accessible to students. Health Educators may consider making a sign that acts as an environmental cue to be mindful. Offering free mindfulness meditation group classes on campus could also increase accessibility and create a welcoming social culture on campus because students could potentially buddy up.

Teaching mindfulness by translating it into Health Education practice on campus through implementing a mindfulness-based mHealth intervention would require designing a simple app that is easy for students to navigate; teaches mindfulness in an easy, low-pressure manner; and teaches the health benefits of being mindful, including its relevance for their student lives. Future Health Education and health promotion campaigns in universities could consider teaching students mindfulness through tailored mindfulness-based text messages that teach them how to be mindful on and off campus. Ideally these messages should be practical,

with real-life tips and suggestions that have a friendly tone. Simple messages about taking a few minutes to breathe before classes or exams could be one way to help students be more mindful, less stressed, and more relaxed given the benefits of mindfulness with regard to stress and weight-related eating behaviors.^{12–14} These educational mindfulness messages should be personalized.

Declaration of conflict of interest

The authors have no conflicts of interest to declare.

Funding

Funding for the study was provided by the UQ Centennial Scholarship and Australia Research Training Scheme Scholarship.

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