Meals for Monsters: a Mobile Application for the Feasibility of Gaming and Social Mechanisms

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CCS CONCEPTS

• **Human-centered computing → User studies**.

KEYWORDS

Avatars, social, gamification, crowdsourcing, community board, nutritional engagement, macronutrients, meal photos.

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Meals for Monsters is a mobile application where users help monster avatars with background stories (e.g., having type 2 diabetes) work on a particular nutritional goal (e.g., reduce carbs) by selecting crowdsourced "in-the-wild" meals to feed them. In this mixed methods study, we deployed Meals for Monsters as part of an online survey (n=68) and interviewed additional users (n=3) to learn whether "neutral" monster avatars might be effective for nutritional engagement and whether the community's response had an influence on their nutritional decision making. Results showed that 39.7% of the users changed answers after viewing community responses which resulted in 14% more accuracy across all items. Strong player-avatar-identification and increased utilization of the crowdsourced community board were strongly correlated to users' enjoyment of the app. Findings suggest how lightweight tools can leverage gamification and social mechanisms to facilitate engagement and reflection on nutrition topics in enjoyable ways.

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1 INTRODUCTION

Nutrition is known to play a critical role in individual health, with several studies linking poor nutrition to an increased risk of chronic conditions including diabetes, heart disease, and obesity [52]. Past work has shown nutritional literacy to be a key barrier and highlighted the importance of helping individuals learn to accurately estimate the macronutrient content of meals as an important part of building healthy dietary habits [31]. However, learning about nutrition is a considerable challenge and obtaining and understanding expert quality nutritional content can be expensive and is not easily accessible for everyone [10].

Past work in HCI has shown the power of gamified systems to make learning and engaging with health information fun, simple, and educational [23, 24, 39]. Simultaneously, work in social computing has pointed to the value of crowdsourcing as a mechanism to support nutritional learning. Several studies have shown individuals are often willing and eager to share their nutrition knowledge to support the education of the community [9, 29, 33]. Furthermore, studies have demonstrated that users are particularly receptive to nutrition suggestions from others [9, 19, 25, 42] and excited to learn from community knowledge [45] and translate this knowledge into behavioral decision making [35].

Building on these insights we propose making nutritional engagement more enjoyable through playful mobile interfaces. Leveraging crowdsourced meal photos and nutritional knowledge, we can design a platform that helps individuals learn about nutrition in an accessible, lightweight fashion. Here we describe a feasibility pilot of Meals for Monsters, a lightweight mobile app designed to help users learn about and engage with nutrition information by "feeding meals" to a monster avatar. Through the app users can view what meals others selected to feed monsters and receive feedback how their monster "react" to eating a meal. In this study we explore how different design mechanisms resonate with lay users and facilitate their engagement with nutrition information. We define *nutritional engagement* as the act of interacting with and increasing awareness of content related to nutritional health. This work provides empirical insights for developing real-world mobile apps and games to support nutritional engagement.

1.1 Crowdsourced Meal Photographs

Photo-based, social meal tracking has gained significant momentum thanks to the increased ease of taking and sharing meal photos via smartphones [7, 14, 57]. Multiple studies examined using crowdsourced meal images for nutritional engagement. Epstein et al. [21] found that users received ideas for completing lightweight, food-related daily challenges by viewing photos of how other users met their own diet challenges. The social exchange of photos that indicated the completion of a user's daily challenge increased engagement, motivation, and accountability. Another study provided crowd workers with both expert and peer-generated feedback to examine accuracy gain in nutritional assessments of different meal photos [42]. Learning and accuracy gain were observed when crowd workers could compare their own solutions to those provided by others. Similarly, Burgermaster et al. [9] investigated the potential of lay and expert feedback to help individuals improve their nutritional literacy from meal photos in volunteer-based communities. Only those who received accuracy feedback (expert and crowdsourced) with explanations showed significant learning gains, eliciting the potential for scaling this approach via crowdsourcing. To the best of our knowledge not many studies utilizing crowdsourced meal photos have focused on user enjoyment and engagement in mobile environments for nutritional engagement.

While there are many components of social mechanisms, Meals for Monsters focuses on incorporating a specific aspect, crowdsourcing, to deliver nutritional information through a community board (see Figure 1B). Users choose a monster avatar to help meet a particular health goal (e.g., train for a marathon) by selecting, from a menu of options, a crowdsourced "in-the-wild" meal photograph which they believed fit their monster's needs. When deciding which meal to "feed" their monster, users can view meal descriptions as well as the community board (see Figure 1B) which contains the reasoning of other members of the crowd on why they selected a particular meal.

1.2 The Use of Player Avatars

Within HCI, a myriad of gamified approaches have been applied to facilitate and improve user engagement in various subject domains including health and nutrition [4, 6, 17, 27, 38, 40, 50]. A gamification technique that has shown promise to engage users is the use of avatars. Avatars are users' visual representation in digital environments. Avatar customization can increase users' enjoyment [6, 43, 53, 55], engagement and presence [50, 54], motivation to play [55], and facilitate self-expression in digital environments such as games [1, 5]. Cosmetic customizations, while does not affect the gameplay, can improve one's self-expression and enjoyment via affecting the appearance of avatars (e.g., choosing hair color) and game objects, and, therefore game environments [16, 56]. A plethora of research has focused on how avatars and customization options, including choice, facilitate higher engagement and enjoyment in games [2, 5, 37, 41, 46, 53, 55, 56]. In health focused studies, it is common to have humanoid avatars that embody the player, serving as an extension of the self [22, 34, 36, 51]. While such representation has shown to be helpful at times, there are many concerns to have an avatar that mirrors one's body image [44, 48]. For instance, in a prior study, women who saw their bodies mirrored while exercising felt worse about themselves than those who did not have mirrored body image [44]. While some studies manipulated users' bodies to prevent awareness of a negative body image [48], in our gamified app, Meals for Monsters, we purposely removed most of the humanoid aspects of the avatar mimicking a few prior studies [8, 28, 39].

To promote user engagement with Meals for Monsters, we incorporated monster avatars with both intrinsic and extrinsic motivators [12, 26]. The monster avatars' appearance changes from "unhappy" to "happy" depending on what meals are fed to them by the user (similar to the tamagotchi), delivering information about the meal and its potential health consequences clearly and tangibly to the user. A user can "level up" (progress to the next status) with a high enough meal score, to make their avatar happier, and can unlock rewards such as hats, toys (see Figure 2) to further encourage customization and avatar identification. Thus, the appearance of the avatars does more than incentivize engagement, but is also an important part of the user's awareness of nutritional information.

We evaluated the app's feasibility in order to understand users' subjective experiences with their monster avatars and crowdsourced meal pictures when deciding what to feed to their avatars. This feasibility pilot used mixed methods approaches consisting of an online survey (n=68) and in-depth interviews (n=3). This work contributes to HCI by: (1) demonstrating how integrating both gamification and social mechanisms (tamagotchi-style avatar nurturing and crowdsourced community board) to facilitate the delivery of nutritional information can help make nutrition more engaging to the public; (2) introducing the role of non-humanoid avatars and crowdsourced intelligence to shape users' experience and enjoyment of a lightweight nutritional mobile app; and (3) providing data on how users might interact with avatars in a nutritional mobile app which differs from prior studies where users interact with avatars in digital environments using large monitors.

2 IMPLEMENTATION AND DEPLOYMENT

Our goal was to gain an understanding of (1) how gamification and social mechanisms influenced enjoyment of the app, and (2) whether these mechanisms had an effect on engaging with nutritional information. In this section, we outline the processes of our feasibility study along with the qualitative semi-structured interviews we conducted.

2.1 Meal Photo Selection, Meal Rounds, and Community Board (CB) Creation

To create the crowdsourced CB in Meals for Monsters, 73 total meal photos were gathered from the researchers' prior studies [18, 45] that used professional dietitians to complete macronutrient assessments. We filtered images based on their resolution quality and content clarity, so that users were able to easily identify the meal components.

In each round of the app, users are presented with four "in-the-wild" meal photos, each accompanied by a brief description of its contents (e.g., Yogurt with apple, grapes and coffee) and must select a meal to feed their monster after reviewing the CB. Each round had one best choice, one second best choice, and two equally less desirable choices, ranked as such by their macronutrient content

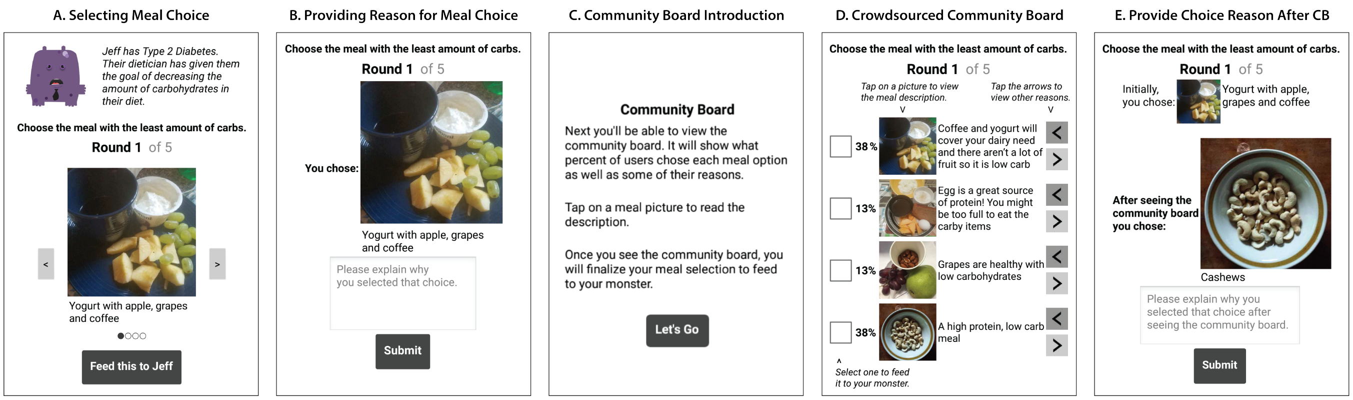

Figure 1: Series of screenshots from the app where users enter their reason for choosing their meal and view the Community Board (CB) information.

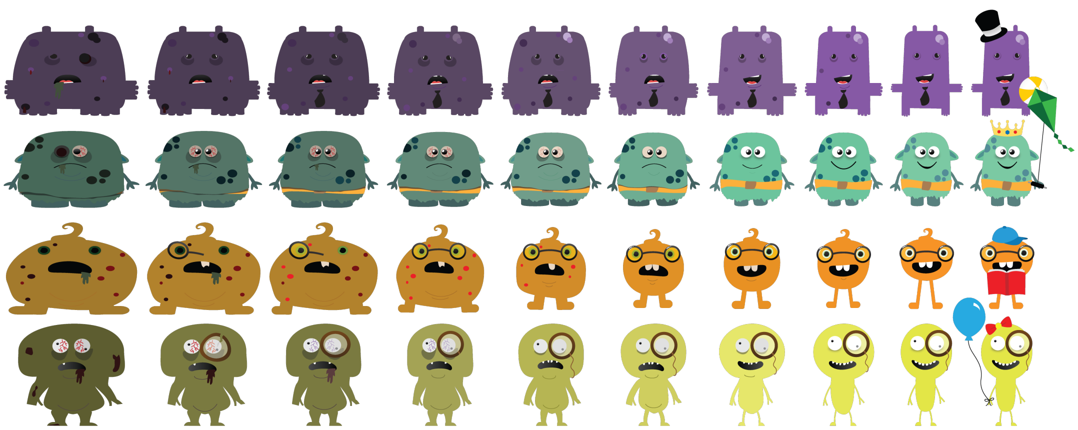

Figure 2: Image of all monster condition stages. Monsters started in the middle, "Neutral," and became "Less Happy" (left) or "More Happy" depending on user's meal choices. The far right shows avatars with the available accessories when unlocked.

assessment. We tested the accuracy of the meal choice rankings by circulating all rounds by volunteer nutrition experts. We then adjusted the questions as necessary to achieve above 50% expert agreement for all rounds.

We used crowdsourcing to generate opinions about which meals might fit a specific nutritional goal. We recruited 56 Amazon Mechanical Turkers and gave them one of the monsters' nutritional goals and had them select meal photos and provide reasons for their choices.

2.2 Gamification and Social Mechanisms for Meals for Monsters

2.2.1 Viewing the Community Board (CB) of Crowdsourced Intelligence. Within each round users could consult a CB with input from the crowd to help them decide which meal best fits the chosen nutritional goal. The CB displayed each meal option for the round, the percentage of the crowd that selected option, and three crowd-generated reasons explaining why they chose that meal option. Fig. 1D shows a sample of the CB that users viewed.

2.2.2 The Ability for the User to Select and Name a Monster Avatar. There are four monsters in the app, each with their own brief background story as to why they are pursuing their nutritional goal. The stories and nutritional goals for all four monsters can be found in Fig. 4 in the appendix. Users could view each monster and select a monster avatar and corresponding health goal to play. After selecting one of the four monsters, users were asked to give their monster a name, which was used throughout the rest of the app.

2.2.3 Monster's State Change and Unlocking Accessories. On the results screen, after users viewed the CB and submitted their final meal choice, they were able to watch their monster avatar react to the meal they chose to feed them. If the monster was fed the best choice meal for their nutritional goal, the user saw their monster avatar's physical state improve in a short animated morph; second best meal, their condition remained unchanged; either of the two worst options, they saw its physical state degrade in the animated morph. If within the five meal rounds, a user answered four or more questions with the best meal option, the user unlocked the accessories screen, where they were able to choose one of four accessories to award their pet monster as shown in the far right of Figure 2. Given the five rounds, users could win up to two accessories.

2.3 Meals for Monsters App Deployment

Users (N=71) were recruited from Amazon Mechanical Turk and social media sites (Facebook and Instagram). They were screened with the following inclusion criteria: 1) own an Android mobile device and 2) above 18 years of age. After accepting the terms of the study found in the consent form (approved by the IRB from the researcher's university), they downloaded an APK file and installed the Meals for Monsters app.

The app begins with the user choosing one of four monster avatars with its an associated story and nutritional goal (e.g., training for a marathon and increasing carbs). Then, for each of the following five rounds, users are shown four "in-the-wild" meal photos accompanied by short descriptions and are asked to select which one best fits their monster's nutritional goal. They are then asked to type in a short reason why they selected that meal as seen in Fig. 1A. Next, users view the CB to look at crowdsourced percentages and user-generated reasons of the meal selections (Fig. 1B). Here, the user can either switch their meal choice or "trust their gut" and keep their original choice. Having seen the CB, the user types in the reason why they either stuck to their prior choice or changed their meal (Fig. 1C). The final meal choice is then fed to the monster, and the round is over and results are shown. The meal choices are randomized within each round, as well as the order of the rounds themselves. The app was created using the visual programming interface, MIT App Inventor 2, version nb185a, and exported as an APK using MIT App Inventor Code, version code36.

2.4 Semi-Structured Interviews

Following the online deployment of Meals for Monsters, we recruited three new users to part take in a 1.5-hour think aloud interview and semi-structured reflection to capture information about user's perception and experience interacting with the app. Users reflected on their general experiences with nutrition and games for health, played Meals for Monsters following a think-aloud procedure, and debriefed on their experience with the app, particularly with the monster avatar and the CB. Following the interview research team coded the main themes to synchronize common themes across interviews.

3 RESULTS

Here, we focus on three key areas: (1) users' general impression with Meals for Monsters; (2) the role of avatar gamification mechanism in shaping users' experiences with the app; and (3) users' attitudes towards the community board. (*All tables for all analyses are provided in the supplementary material for full description and inspection.*)

A total of 71 users tested the pilot version of the app. Sixty-eight played it independently as part of the online survey and three users engaged in an in-depth, think-aloud session via Zoom with researchers while playing the app. Demographic characteristics for each group are noted in Table 1.

3.1 General Experiences with Meals for Monsters

In general, users enjoyed the app and premise of a mobile app with monsters to learn about nutrition in a casual way. They liked experiencing the app and found it a useful tool for reflecting on nutrition. A representative quote is: *"This was fun and I think someone can learn a lot about nutrition through trial and error via this [app] instead of using their own body as an experiment"* (ID-072).

Users spent an average of 217 seconds (SD=129sec) in the app to play all five rounds, which is relatively short. One user wanted to experience the app for an extended period and expressed that a better narrative might improve the app's potential: *"My investment might have been higher if it was longer and there was more [continuity]...Overall great [app] with great potential. Perhaps if the narrative and continuity is further developed"* (ID-243).

In a post-hoc analysis, we found that lower educational background was associated with higher app enjoyment (p=0.021, Cohen's d ES=0.59), but was not associated with the rating and recommendation of the app.

3.2 Avatar Gamification Mechanism in Meals for Monsters

Users were intrigued by using an avatar to think about nutrition. They reported as primary reasons for selecting an avatar for the app to be: i) because they or someone they knew were working on the same goal, ii) they wanted to learn more about the health goal, and iii) they liked the appearance of the monster. Think-aloud interviews with users supported these results. One user noted: *"I'm most interested in...the one that's to train for a marathon...I do high endurance activities...like very physically taxing activities...So...I'd be curious to know how [marathon runners] prepped"* (ID-001). Another user was very specific about their connection with the avatar: *"Part of [the avatar's] plan is managing their diet and decreasing the fat content...that's something I identify with, that I would like to be able to make that [happen], so I'm like, I wanna help this monster!...It has more of that incentive...there's that connection"* (ID-002).

We were particularly interested in how users' affinity towards avatars related to their app experience. Using four player-avatar-identification (PAID) items, we found stronger identification with the avatar significantly correlated to greater app enjoyment (B=0.11, p<0.001), rating (B=0.22, p<0.001), and recommendation (B=0.92, p<0.001). Further post-hoc analysis showed that user's PAID score did not vary significantly across any demographic categories other than education; users who reported having a high school education or less identified significantly more with their avatars (Independent T-Test; p=0.003, Cohen's d ES=0.77).

Think-aloud interviews highlighted that users liked the slightly human background stories of the avatar, finding the monsters relatable but not overly humanoid in appearance. However, the gradual physical changes to the avatar often went unnoticed by users while interacting with the app, making it feel unrewarding. A clear action, such as electing an accessory after four correct rounds felt rewarding, though difficult to obtain. One user described this experience

	Crowdsourcing (n=54)	Pilot (n=68)	Interviews (n=3)
Age (median)	25-34	25-34	35-44
Gender	20% female; 80% male	44% female; 56% male	33% female; 67% male
Education	3.5% HS/GED or lower; 96.5% HS/GED +	50% HS/GED or lower; 50% HS/GED +	0% HS/GED or lower; 100% HS/GED +
Macronutrient Confidence (post-pre)	—	6.07 percentage pts (std. dev. 14.27)	28.33 percentage pts (std. dev. 22.54)
Macronutrient knowledge	Not at all: **3/54** Not too much: **13/54** A moderate amount: **16/54** Quite a bit: **13/54** A great deal: **9/54**	Not at all: **5/68** Not too much: **15/68** A moderate amount: **17/68** Quite a bit: **12/68** A great deal: **19/68**	—
Recruitment	100% AMT	50% SM; 50% AMT	100% SM
Compensation	$4	$6	$30
IRB Approval	Yes	Yes	Yes

Table 1: User Demographics. HS: High School, GED: General Educational Development, Macronutrient Confidence: positive percentages indicate increase in self-reported macronutrient assessment confidence post Meals for Monsters play, AMT: Amazon Mechanical Turk, SM: Social Media.

of delayed gratification noting: *"The whole little monster guy, like I don't know if he was supposed to be changing [through the app]. If he was, it was in very subtle ways that I didn't realize until the very end..."* (ID-003).

3.3 Social Community Board (CB) Mechanism in Meals for Monsters

The second major feature in Meals for Monsters was a crowdsourced CB where users could review other users' justifications when selecting a meal to feed the same monster. Overall, users reported that the CB influenced their responses about half of the time (M=3.13, SD=1.39) and they agreed with the CB a little more than half of the time (M=3.81, SD=0.99). Broadly, user experience with the CB did not vary significantly across any demographic categories.

Users' self-reported influence by the CB's information was significantly correlated with their enjoyment of (r=0.38, p=0.001), rating of (r=0.31, p=0.011), and willingness to recommend the app (r=0.43, p<0.001). Overall, 27 out of 68 (39.7%) users changed at least one of the five answers after reviewing the crowdsourced answer of the CB. This led to 48 correct (14.12% of all possible answers across users) and 6 incorrect (1.8%) answers.

Qualitative interviews provided preliminary insights on users perceptions and reasoning with the CB. Interviewees had differing impressions of the CB as they played the app. Overall, users did not feel like they could necessarily trust the opinions of the community, finding them inconsistent. User ID-001, who had correctly disagreed with the community on previous rounds found themselves uncertain when considering a pizza to feed their monster expressing: *"Seems like everybody went with the pizza, which now [is] starting to worry me because earlier...they had the wrong answer."* Another user reflected: *"The community was really inconsistent. For some things, it seems like the community demonstrated the same basic knowledge of nutrition I had, but for other questions they disagreed and showed a lack of understanding "* (ID-003). However, users noted that seeing the choices and reasoning from others in the community was informative and prompted their own reflection and helped them make their own judgements. One user explained their experience with the CB saying: *"It's not necessarily like, [the] 'expert board,' you know? Like, it has the majority...so if...100 people had chosen the burger, for the [lowest] fat content, I would've been like, no, 100 people are wrong, but...also taking into account what the reasons were for those choices helped"* (ID-002).

4 DISCUSSION

We piloted Meals for Monsters (N=71) with an online survey (n=68) and semi-structured interviews (n=3), as a feasibility-focused pilot study to investigate the effectiveness of two main design mechanisms, namely use of monster avatars and a crowdsourced community board (CB), on nutritional engagement.

Overall, we found users reported positive experiences with their monster avatars. The Player-Avatar-Identification (PAID) score and engagement with the CB were strongly correlated with enjoyment, rating, and recommendation of the app to others. In particular, users who reported having a high school education or less identified significantly more with their avatars compared to those who had higher education degrees. While we are not aware of a prior study with similar findings, it is possible that monster avatars made nutritional information more enjoyable, accessible, or easier to retrieve through visual effects as opposed to text alone for people with lower education degrees. Additionally, some users were able to "unlock accessories" for their avatars and customize their appearances (see Fig. 2) which may have assisted with connecting with their avatars, as cosmetic avatar customization can be strongly related to identification [56].

Users commonly reported selecting an avatar because it had the same nutritional goal as themselves or someone they knew. It is possible the avatars' goals helped the users feel more associated with the characters by taking a form of "ownership" of the avatar. It is not uncommon for users to view their avatars as an extension of themselves "to serve as a 'buddy' for empathic support and guidance and as a surrogate for rewards" [36]. Extant research showed that technical abilities [49] and empathy capacity of the character [15], as well as a visually appealing avatar [30], have been recognized as factors that assist with player-avatar identification [56]. In future studies, we would like to include more characters with different health goals and explore whether having users type in their own health goals may impact their experiences with the app as well as nutritional literacy outcomes.

The influence by the CB was strongly correlated with enjoyment of the app. However, the influence of the CB on decisions was complex. Some users were hesitant accepting the crowd's opinion if they had a strong opinion themselves. Though there is literature on how crowdsourced or friendsourced plans can encourage individuals' behavioral change efforts [3, 19], one challenge with these environments is a lack of ground truth or expert consensus. In this study, meal photos were reviewed by expert nutritionists and changes to avatars made in accordance with expert consensus on macronutrient proportions as a proxy for ground truth. However, as the users mentioned when interacting with the community board, the crowd is subject to error. Beyond the scope of this study, this error is particularly pronounced in nutrition where even experts themselves have a hard time agreeing on various topics [9, 11]. Prior research investigated engaging crowd workers in assessment of logical reasoning with the hope of training the crowd workers to produce more quality work [13, 20]. Future work involving crowd workers and nutritional information may consider training the crowd workers on how to consider the nutrition in meals. This will be crucial when users take photos of their meals, as a well trained and informed crowd may be more consistently able to evaluate meals and filter "incorrect" meal assessments.

4.1 Lessons Learned and Future Work

From this feasibility pilot several lessons have emerged that will guide future iterations of our gamified social app to help users engage with nutritional information and may inform the design of other health related interventions.

(1) The changes to the avatar appearance must be more salient to be a more effective feedback mechanism to reflect the avatars' status in relation to their health goals. Using avatar customization on a small mobile screen for nutrition is quite rare, since most avatar customization studies use more immersive environments such as VR. Future work may investigate how to achieve making the changes in avatars more visceral on mobile devices. Furthermore, it is important for researchers to carefully consider changes in avatar appearance (e.g., color, body shape) which may unintentionally stigmatize users and impact their well being and motivation. Instead, designers can opt for more salient methods for providing feedback such as adding accessories and including dynamic dashboards.

(2) Awareness of the rewards and optional incentives can assist in engaging users, and therefore help them care about the content of the app. While this app utilized avatars that changed states in response to their performance, users were not made aware of the full range of forms their avatars could take. Only those who answered four consecutive rounds correctly "unlocked accessories" for their avatars. Future iteration may also provide more options to interact with and customize the avatars to engage users.

(3) Individuals should be aware of any "health status" changes in a relatable and salient way on a small mobile screen [47]. Utilizing sound, vibration, and longer animated morphs are some lessons we can take from the commercial Saga game series from King Digital Entertainment such as Candy Crush and Bubble Witch [32].

(4) A crowdsourcing platform such as our community board needs to become more interactive with a potential expert versus non-expert status indication to aid users in their informed decision making. Finding ways to resolve conflicting nutritional evaluations with upvotes and downvotes from online experts or experienced online health communities would be of value in creating a more robust, crowdsourced platform.

Building on these lessons, we aim to develop Meals for Monsters into a fully-fledged game to engage users with nutritional literacy in everyday lives, learn from each other, and ideally improve their health behaviors.

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A SUPPLEMENTARY FIGURES & TABLES

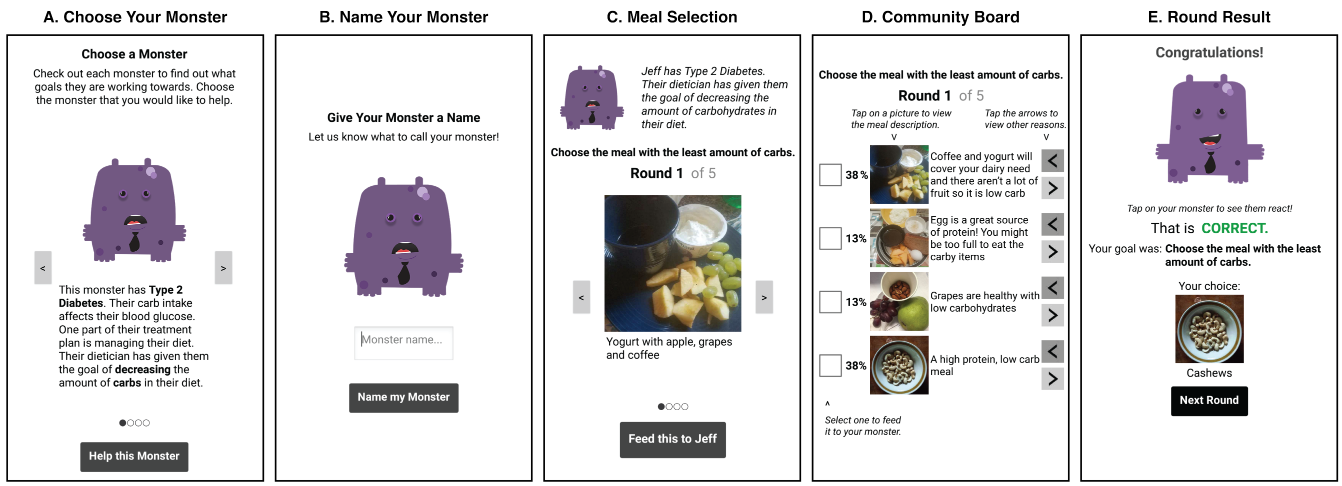

Figure 3: Series of screenshots showing the main steps of the Meals for Monsters app.

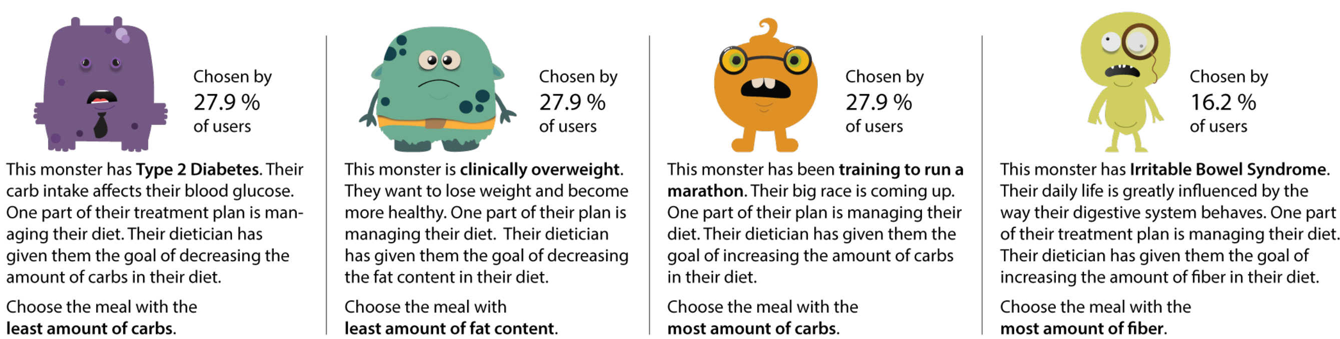

Figure 4: The four monster choices with their corresponding conditions and macronutrient goals, as well as the percentage of users that chose each (n=68).

Table 2: Player Avatar Identification (PAID) score and App Enjoyment. Simple linear regression with app enjoyment as the dependent variable; PAID score as the independent variable. $^{***}p < .01$, $^{**}p < .05$, $^{*}p < .1$

	B	SE	Beta	t	p	R^2	Adj. R^2	F	p
Model (constant)						.266	.255	23.598	0.000
PAID	0.110	0.023	0.516	4.858	0.000***				

Table 3: PAID score and App Recommendation. Simple linear regression with app recommendation as the dependent variable; PAID score as the independent variable. ***$p < .01$, **$p < .05$, *$p < .1$

	B	SE	Beta	t	p	R^2	Adj. R^2	F	p
Model (constant)						.212	.199	17.444	0.000
PAID	.092	.022	.460	4.177	0.000**				

Table 4: PAID score and App Rating. Simple linear regression with app rating as the dependent variable; PAID score as the independent variable. ***$p < .01$, **$p < .05$, *$p < .1$

	B	SE	Beta	t	p	R^2	Adj. R^2	F	p
Model (constant)						.225	.213	18.545	0.000
PAID	.220	.051	.474	4.306	0.000***				

Table 5: PAID by Education Group. Independent t-test comparing PAID scored by Education Group (high school and below, high school and above). ***$p < .01$, **$p < .05$, *$p < .1$

Pair	N	Mean	Std. Dev	t	Sig. (2-sided)
PAID (HS/GED v. over HS/GED)	66	3.226	1.028	3.139	0.003**

Table 6: Community Board Influence (CBI) and App Enjoyment. Simple linear regression with app enjoyment as the dependent variable; CBI as the independent variable. ***$p < .01$, **$p < .05$, *$p < .1$

	B	SE	Beta	t	p	R^2	Adj. R^2	F	p
Model (constant)						.146	.133	11.093	0.001
CBI	0.267	0.080	0.382	3.331	0.001***				

Table 7: CBI and App Rating. Simple linear regression with app rating as the dependent variable; CBI as the independent variable. ***$p < .01$, **$p < .05$, *$p < .1$

	B	SE	Beta	t	p	R^2	Adj. R^2	F	p
Model (constant)						.097	.083	6.869	0.011*
CBI	.469	.179	.311	2.621	0.011*				

Table 8: CBI and App Recommendation. Simple linear regression with app recommendation as the dependent variable; CBI as the independent variable. ***$p < .01$, **$p < .05$, *$p < .1$

	B	SE	Beta	t	p	R^2	Adj. R^2	F	p
Model (constant)						.186	.173	14.817	0.000***
CBI	.281	.073	.431	3.8491	0.000***				