Identifying Potential Gamification Elements for A New Chatbot for Families with Neurodevelopmental Disorders: A User-Centred Design Approach

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Abstract

Background: Chatbots have been increasingly considered for applications in the healthcare field. However, it remains unclear how a chatbot could assist users with complex health needs, such as parents of children with neurodevelopmental disorders (NDDs) who need ongoing support. Often this population must deal with complex and overwhelming health information, which could make parents less likely to use a software that might be very helpful. One approach to enhancing user engagement is incorporating game elements in non-game contexts, known as gamification. Gamification needs to be tailored to users, but there has been no previous assessment of gamification use in chatbots for NDDs.

Objective: We sought to examine how gamification elements are perceived and whether their implementation in chatbots would be well-received among parents of children with NDDs. We discussed some elements in detail as the initial step of the project.

Methods: We performed a narrative literature review of gamification elements, specifically those used in health and education. Among the elements identified in the literature, our health and social science experts in NDDs prioritized five for in-depth discussion: goal setting, customization, rewards, social networking, and unlockable content. We used a qualitative approach, which included focus groups and interviews with parents of children with NDDs (N = 21), to assess the acceptability of the potential implementation of these elements in an NDDs-focused chatbot. Parents were asked about their opinions on the five elements as well as rating them. Video and audio recordings were transcribed and summarized for emerging themes using deductive and inductive thematic approaches.

Results: From 21 participants, we identified three main themes: 1) parents of children with NDDs were familiar with and had positive experiences with gamification; 2) a specific element was important to all parents (goal setting), whereas others (customization, rewards, and unlockable content) received more mixed opinions; and 3) the social networking element received positive feedback, but concerns about information accuracy were raised.

Conclusions: We showed for the first time that parents of children with NDDs support gamification use in a chatbot for NDDs. Our study illustrates the need for a user-centred design in the medical domain and provides a foundation for researchers interested in developing chatbots for medically vulnerable populations. Future studies exploring a wider range of gamification elements with a larger number of potential users are needed to understand the impact of gamification elements in enhancing knowledge mobilization.

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Keywords: gamification; chatbot; neurodevelopmental disorders; engagement; mHealth; eHealth; focus group; interview; user-centred design; health information technologies.

Introduction

Neurodevelopmental disorders (NDDs) include a wide range of disorders such as autism spectrum disorder (ASD), intellectual disability (ID), cerebral palsy, and attention-deficit hyperactivity disorder (ADHD), affecting approximately 3-18% of the population worldwide [1–3]. The health and well-being of families with NDDs are significantly lower than non-NDDs groups, as children with NDDs and their parents experience complex medical, social, and educational challenges [4]. Parents of children with NDDs face unique hardships, including managing communication between healthcare and social providers, implementing therapeutic recommendations, and maintaining their children’s medical health records while constantly advocating for their best care [5–7]. The costs associated with the care of a child with NDDs are also substantial, which results in higher rates of parents’ depression and anxiety symptoms [8–10]. A significant challenge that parents often experience is navigating complex health information in a short amount of time to care for their children. However, knowledge mobilization in NDDs is not easily achieved [11–13]. Thus, the advent of innovative technological tools that facilitate knowledge sharing, such as chatbots, could significantly benefit these families [14–17].

Chatbots are artificial intelligence (AI)-based tools with natural language processing capabilities that act as virtual conversational agents mimicking human interactions [18]. Although they are not used yet in NDDs, chatbots could provide much-needed support to parents. Chatbots can conduct health surveys, generate health-related reminders, communicate with clinical teams, schedule appointments, retrieve and analyze health data, or translate behavioural indicators such as physical activity, sleep, and nutrition into diagnostic patterns [19]. Chatbots also present several advantages in the health domain in general. They compensate for staff shortages, provide anonymity, convenience, and faster access to information, and lessen the reluctance to share sensitive (e.g., emotional and factual) information [20]. For instance, chatbots used for sexual health and mental health settings showed that participants were more likely to disclose information needed for treatment with a bot rather than with a human [21]. Chatbots can be positioned in an online environment that is well-known to families, such as social media messaging platforms (e.g., WhatsApp and Facebook), making them more visible to most families living with NDDs [22,23]. Thus, health chatbots are generally seen positively by internet users [24], as they could increase access to healthcare and improve doctor-patient and clinic–patient communication [25,26].

A critical consideration when working with families living with NDDs is that it is important to engage in a sustained relationship (akin to coaching) with them for the best care. Their children will present different needs over time as their development emerges, so we pondered whether implementing gamification could provide more sustained use of the chatbot, hence, providing better care [27–29].

Gamification implements game-based mechanics such as social networks, customization, points, badges, and progress bars into non-game contexts [30–32]. Gamification has been used widely in online and mobile apps and assessed across various settings, including education [33] and healthcare [34] to increase user engagement [30,34–36]. In the health research community, gamification in mobile health applications has received considerable interest for its potential to motivate behaviour change [37–39]. Nevertheless, gamification elements have not yet been studied extensively in chatbots [40,41].

There are important caveats to consider when implementing gamification as a product that utilizes gamification should not be assumed to increase user engagement [37,42,43]. Without careful consideration of the application context, user characteristics, and content quality, gamification can yield negative impacts in terms of behaviour change [38,44].

Considering existing knowledge gaps in gamification use in chatbots for the health domain and knowing that misplaced gamification could potentially compromise the chatbot usage [45], we aimed to 1) better understand if gamification would be considered positive for user engagement in a chatbot for NDDs-knowledge mobilization and 2) discuss some commonly used gamification elements to evaluate whether they are beneficial from the perspective of parents of children with NDDs.

Methods

Design

Given the lack of research studies on gamification in chatbots for healthcare, we first conducted a narrative literature review to identify potential gamification elements. We reviewed the literature from Google Scholar and PubMed, using the keywords: “gamification,” “engagement,” “motivation,” “healthcare,” “education,” “neurodevelopmental disorders,” and the related diagnosis terms “autism” and “intellectual disability.” These terms were suggested by our teams of clinical and social sciences researchers. We did not identify any gamification elements that are specific to NDDs. Nonetheless, we found several meta-analyses discussing the most common gamification elements used in online applications [35,44,46,47]. As we intended to identify elements that could be implemented in our chatbot to inform, guide, and teach parents of children with NDDs, we also examined elements that have been used more specifically in education and healthcare [30,32]. We then compiled a list of the gamification elements identified in the literature and discussed it with our research team of computer scientists, health and education professionals with extensive expertise in interacting with families of children with NDDs. This was to prioritize the elements that could be discussed in-depth with the families.

Several gamification elements were concluded to be relevant and valuable, such as “goal setting” and “social networking” [48,49], which have been identified in clinical coaching programs and applications, “rewards” and “customization” [50], and “unlockable content” [23,24]. We compiled these elements in **Table 1**. “Goal setting” refers to the users’ ability to create specific goals for their children (e.g., behavioural goals such as potty training and bike riding) to help create appropriate learning and training plans. “Social networking” refers to integrating a virtual space or forum for users to discuss and share their experiences. “Rewards” indicates intangible prizes being given to the users by the application every time they reach a goal or complete a task (e.g., badge). “Customization” refers to the users’ ability to change the theme of the application interface, profile picture, notification frequency, and user avatar. “Unlockable content” suggests that certain content can be restricted to users until they reach a certain level of participation or usage to encourage engagement. For all elements, visual examples were also prepared to show to participants, ensuring a better understanding of them.

Table 1. Gamification elements investigated in the study.

Gamification elements	Definition	Examples
Customization	Ability to change features of the app.	Notification, avatar, theme.
Rewards	Intangible prizes for every task completed.	Badges, coupons.
Goal Setting	Users’ ability to create specific goals.	Potty training, bike riding.
Unlockable Content	Restricting contents to users who reached certain levels of participation or usage.	Meditation, self-help articles.
Social Network	Integrating a virtual space to discuss and share experiences.	Forum.

For a product to succeed, users' needs must be taken into account during the development and implementation of that product, and later evaluation must be performed to ensure that these needs are met. User participation is essential to reflect on the values, drivers, and goals of the chatbots that are to be developed. This is evident in previous studies that highlighted the importance of user participation when developing eHealth technologies, as seen in the CeHRes roadmap [51]. Thus, we considered different approaches to seeking feedback from families of children with NDDs on implementing gamification elements in a chatbot for NDDs. We integrated two key product design approaches: user-centred design and double diamond approach.

The user-centred design (UCD) approach [52] consists of several methods that take end users’ needs into account, one of which is asking end-users about the tasks and goals of the application. This approach allows users to influence how an app takes shape and increases users’ acceptance. UCD could reduce the development time as usability problems are identified and resolved through frequent communication with users before the system is launched [53–55].

Similarly, according to the double diamond method, there are four design steps, with the first two involving clarifying the problem, discovering and defining before a product is developed and delivered [56,57]. Identifying which gamification features that parents would find beneficial or deterring could ensure better reception of the application later on.

We adapted the structures of the surveys used previously to evaluate user engagement post-gamification application [58–60] and developed our guide for semi-structured interviews and focus groups. The guide aimed to explore participants' (parents of children with NDDs) previous experiences with technology and gamification, their opinions on the gamification elements being investigated, and their views on how they should be implemented **(Table 2).** As part of this project, we did not conduct a usability test. Our goal was to identify gamification elements which would be later included in our chatbot prototype. We will conduct usability tests in the future to test their impact on user experience.

Table 2. Questions and prompts that were used in the parent focus groups and interviews.

Number	Main Questions	Prompting Questions
1	Can you share with the group an experience you have had with an application that uses engagement mechanisms? If you have not had one, can you please outline what you have observed from other family or friends that have?	a. What did you like about your experience? b. What did you dislike about your experience?
2	When you think of **goal setting** to improve behaviours, what are the first thoughts that come to mind?	a. How do you feel about setting your own goals in an application, as opposed to an application setting a goal for you? b. How would you feel about **customizing** the application to send you reminder notifications about your goal for the day? (If participants like the idea of reminder notifications, 'how often would you like to receive these notifications?') c. Would it be rewarding to receive some form of **online rewards** for making improvements through goal setting (e.g., an online badge)
3	What are your thoughts on	a. What kind of surprise content

	including **unlockable content** in the Chatbot?	would you like to see, and how could this be done well or poorly? (e.g., colour theme) b. Do you think you would find this engaging? Do you think unlockable content should be included in the Chatbot?
4	What comes to mind when you think about the option of including a **social network** in the Chatbot?	a. What kinds of conversations would you want to have with other parents? b. Let’s say we include a FAQ board and a regular question board where parents could post their questions. How would you feel about parents policing the quality of the responses posted by other parents? c. Would you use the questions section of the Chatbot if there was the potential for it to include fake news and/or information that was not validated by experts? d. If we move forward with this, how would you like to **customize** the way you are represented? (e.g., logo, name, picture, and how much information would you like to reveal) e. Would you prefer for the Chatbot social network to be linked to another social networking platform such as Facebook or be independent?
5	When we write up our report, what is one important point you think we should pay attention to from our discussion today?	a. What topics would you like us to talk about in the future?

This project was approved by the Research Ethics Board at the University of Alberta. All participants gave written informed consent before the sessions. The study was advertised with NDDs-focused parent organizations, including Kids Brain Health Network (KBHN), Canadian Autism Spectrum Disorder Alliance (CASDA), and CanChild, via social media (Facebook and Twitter). Participants were then recruited via convenience sampling [61].

Participants

We held 7 focus group sessions and 4 semi-structured interviews, including a total of 21 participants, all of whom were parents of children with NDDs. While our goal was to follow the same session format for all participants, we followed a pragmatic approach to the session type to accommodate participants who either had limited time availability, flexibility or, in rare cases, preferred to be interviewed alone. In all cases, we followed the same questions detailed in **Table 2**.

Procedure

As a result of the COVID-19 pandemic, all sessions were conducted virtually using Zoom and recorded both for video and audio. Recordings were saved on our secured server (University of Alberta, MedIT). The identifiable information of the participants was stored in a secure encrypted manner. Similarly, the audio and video recordings of the interviews and focus groups were stored in our secure server and only available to the research coordinators and assistants directly involved in data analysis. The participants agreed to have their data collected and stored as per our written consent form. The sessions ranged from 45-60 minutes and used a semi-structured format, containing five main questions and 2 to 5 prompting questions **(Table 2)**.

The focus group size ranged from 2 to 4 participants, whereas interviews had 1 participant each. Due to time constraints, and since it is commonly not feasible to focus solely on individual views in a focus group, not all participants responded to every question in the focus groups, as seen in previous studies [62,63], but we ensured to cover all questions. We also analyzed the transcripts for common responses for each question **(Table 5)**. We then organized the results to represent three main themes, capturing the consensus between participants (**Table 5**).

Data analysis

Videos were transcribed automatedly using Otter.ai, a tool that uses AI to transcribe audio. The transcripts were then edited manually to correct errors, remove identifying information, and ensure that all speakers were correctly labelled. Key answers and comments were extracted and analyzed using deductive and inductive thematic approaches [64–66]. The rating of the different gamification elements provided by participants was noted and compiled.

Open texts from the participants’ responses were included in the manuscript. Participants' novel and impactful insights regarding the proposed gamification features were recorded. Participants were asked to comment on whether a gamification element was a “must-have,” “nice to have,” or “not needed” feature. Participants were not obliged to comment on every aspect. Common statements from participants were then used to generate main themes using thematic analysis [67]. We followed some of Lincoln and Guba’s techniques to establish credibility and confirmability for the study, such as triangulation of sources and analyst triangulation [68].

Results

A total of 21 parents of children with NDD agreed to participate: 18 participants out of 21 (86%)

were Caucasian, 18 (86%) were female, and 16 (76%) were from Alberta, Canada **(Table 3).**

Table 3. Demographic characteristics of participants of the study.

Demographic characteristics	Participants (N = 21), n (%)
Gender	
Female	18 (86)
Male	3 (14)
Race or ethnicity	
Caucasian	18 (86)
Asian	3 (14)
Region	
Alberta, Canada	16 (76)
British Columbia, Canada	1 (5)
Ontario, Canada	1 (5)
Quebec, Canada	3 (14)

Findings from the focus groups (7 sessions, 17 participants) and interviews (4 sessions, 4 participants) were reviewed, which showed similar response trends and were, therefore, combined **(Table 4)**.

Table 4. Participants’ preferences towards including different gamification elements in a chatbot for NDDs.

Gamification features	Total participants’ response n (%)			
	“Must-have”	“Nice to have”	“Not needed”	Total responses
Customization	4 (36.5)	4 (36.5)	3 (27)	11
Rewards	–	11 (65)	6 (35)	17
Goal Setting	19 (100)	–	–	19
Surprise/Unlockable Content	–	6 (32)	13 (68)	19
Social Network	12 (60)	5 (25)	3 (15)	20

Table 5. Summary of parents’ input showing key themes about gamification elements.

	Main themes and related key concepts	Number of Participants
1	**Parents of children with NDDs were familiar with gamification**	
	Participants had prior experience with gamification elements	21
	Gamification elements are beneficial or somewhat effective	12
2	**Specific gamification elements should be incorporated into a chatbot for NDDs**	
	Goal setting is an important feature for the chatbot	19
	A goal template that could be personalized is needed	15
	Reminder frequency needs to be adjustable by users	21
	Unlockable content (e.g., resources) is deterring or off-putting	13
3	**The inclusion of social networking is favoured and the topic of medical fact-checking is controversial**	
	Social networks increase social support for parents	15
	Social networks connect parents with similar experience	16
	Social networks help parents share good resources	21
	Social networks should be implemented	17
	Moderators are needed for social networks	14
	Medical misinformation can be displayed on social networks	11
	Medical misinformation should be filtered on social networks	9
	Parents should have control over their representation on social networks	21

Parents of children with NDDs were familiar with gamification

The study's main goal was to assess if gamification would be perceived as being potentially useful in sustaining chatbot engagement and fostering usage for better knowledge mobilization. We found that all 21 participants (100%) had some experience with gamification in online and mobile apps, and 12 out of 21 participants (57%) reported from their experience that the tools were beneficial or somewhat effective (**Table 5**).

Specific gamification elements should be incorporated into a chatbot for NDDs

Our next objective was to discuss some gamification elements that have previously been used in health or education domains and evaluated to be beneficial for NDDs population by our team of health and social science experts.

We found robust support for goal setting, which is one of the main tools used in clinical settings for families with NDDs [69,70]. Out of 19 participants who commented on goal setting, 19 (100%) rated (e.g., for behaviour management) as a "must-have" feature. Out of 21 participants, 19 (90%) noted that goal setting would be very important for the chatbot, and 15 (71%) proposed the idea of having a "goal template" to choose from, which could be modified to fit their child's unique needs. When being asked why a goal template is a "must-have" feature, they mentioned that goal setting would be important for new parents and recently diagnosed children.

> "[P]arents that are newer [...] they would need that template because they wouldn't know what to do."

> "[H]aving some suggested goals for those people who can't think of their own goals. Because when you're at the end of your rope, you can't always think cohesively, actually, because a lot of our parents are burnt out or have caregiver PTSD. So sometimes, it's hard to think of your own goals, and you already feel like you've tried everything. So having some suggestions that you can customize with at least as a starting point would be beneficial."

Participants gave mixed responses on customization (e.g., colour theme, reminder frequency). 21 participants (100%) wanted the ability to control the frequency of reminders being sent to them when a goal is completed. This is important because parents often feel overwhelmed and pressured, as mentioned previously. Among 11 participants who commented on customization, 4 (36%) stated that it is a "must-have," 4 (36%) agreed that it is "nice to have," and 3 (27%) said that it is "not needed." We showed that while some parents take interests in customization, their main goal is to gain information for their children. Among participants who answered that customization is "not needed", they highlighted that reminders and notifications could bring a strong feeling of pressure.

> "[H]aving customizable, so you can choose the frequency [notification], whether you want once a day or once a week, [...] sometimes that nudge is needed. [I]f it's

> repeated, and it's not wanted, it could just be adding that pressure on that you're not doing- you already feel like you're failing your child. And when it's reminding you over and over again, and you don't want it to be then you're feeling the weight of that failure over and over again.”
>
> “The parents should have [...] a snooze button [...] because it can be annoying if the parent feels pressured.”
>
> “[W]hen I started [...] I need […] daily, but after a while, I might want to change it. So I think that having it customizable will be very important. And each parent is going to have a different type of personality. And some parents might want more than one today and some parents might not want reminders at all.”
>
> “ [B]ecause I'm single mother, [...] sometimes I just forget to check down my goals. If some apps or application could remind me to set up my goals and the follow up, [...] that would be great.”

Among parents who rated customization to be “nice to have”, they stressed that they value the content more than the presentation or the option to customize the colour theme and user interface.

> “I think that you want to engage the parents to have a very visual and very easy […] format […] to be user friendly. And they pay attention to that […] more so than […] what color they can change […] a lot of us parents are hungry for information, for references, links to research.”
>
> “[Y]ou're coming from a place of nothing, a lot of the time and you're giving more than you even have, you would either feel it would add to the parental guilt, or […] it would cause you to be like, disengaged. [E]ven the most willing participant who wants to change things and really wants help, you could be very overwhelmed if it was not messaged correctly.”
>
> “They just want an answer. They just need help. They're so desperate for someone to help them and find resources and access to things and the rest of it, while nice and might draw someone's eye in […] isn't necessarily going to make or break.”
>
> “[P]eople want to use this app, they're desperate. They need the information [...] concisely [...] and offering […] a variety of colours across the rainbow isn't why someone's drawn to that app.”

Parents who said customization is a “must-have” feature commented on the need to have the app tailored to individual child, as each has very different needs.

> “It needs to be customizable, because parents are different, kids are different, even if they have the same diagnosis and situations are different. When you're trying to achieve a goal, some things will work for one kid, but not for another [...] It needs to be customized to the particular parent and child and situation.

> “[I]t needs to be customizable, if you have more than one child with the extra needs.”

Similarly, responses to using rewards such as badges were mixed. 11 out of 17 participants (65%) who commented on rewards rated it as being “nice to have”, but 6 (35%) said they would prefer not to have them. 11 out of 21 participants (52%) stated that virtual badges, which are a type of reward, are not rewarding, while the other 6 (29%) indicated that they are “nice to have”. The idea of the bot providing rewards may be perceived as putting the focus on the user (parents) and not children with NDDs, which seems to trigger some negative feelings.

> “I do it not because I want to be rewarded. My reward is to see my child doing well [...] when we see our children do well, that's already a reward.”

> “I think it would be beneficial [...] but I think it has to make sure like it's really tailored to this audience of parents that are totally burned out. [...] If it's too glossy and not meaningful [...] it won't mean anything and it won't resonate. It won't entice anyone to use it.”

> “It's not [...] something that draws me to the app. I like the functionality of the app, not the awards. But I think that some parents, especially some younger parents might need those pats on the back.”

> “[T]hey're not significantly motivating for me. For me, it's more about the personal engagement. So if I want to do what it is, whatever the activity is, then I'll do it and irrespective of things like badges or rewards. [F]or me, the engagement tool that's most successful is tracking, [...] one where I can track my progress or my participation.”

However, to some parents, this could be a beneficial mode of reinforcement.

> “[T]hat can be a good reinforcement. And then it can, it can show the options of the reinforcement, if you are getting 50 points, you will have this medal or this badge or if you get 100 points, you'll be getting a silver one or a gold or platinum,

> that is some positive reinforcement that the more we put our energy towards it and we get more successful. So the chances of success increase.”

Another frequently used gamification element in apps is unlockable content. 13 out of 21 participants (62%) did not support unlockable content, especially if helpful information or resources were being restricted. The main goal of parents was to identify trusted and relevant resources while working under time constraints. Thus, locked content was perceived as negative and detrimental to their journey.

> “If I'm working on something like this, I don't want surprises.”

> “[T]hose parents already are motivated. [T]he focus is not trying to how to motivate them, [...] is to be able to help them even more with resources, [...] and not to lock it out from where they can get access to. [T]hese parents deserve to be given as much as scientists and researchers can provide.”

> “[I]f it was unlockable content, I'd be kind of annoyed I couldn't have it upfront if it was something I actually needed or had a question about.”

> “I just think that if I need the information, I want to be able to access it. So making me jump through hoops to get it feels like something you'd be doing in the system, like in the public systems, jump through to get the information. I don't feel like that’s user-friendly.”

> “[U]nlockable content is like putting cookies on the highest shelf in the cupboard, it feels like it's a lack of trust and a lack of understanding where we're really coming from. [It’s like] having [...] affirmation [...] locked.”

The inclusion of social networking is favoured and the topic of medical fact-checking is controversial

The topic of social networks revealed the complexity of implementing a chatbot in the medical domain. 12 out of 20 participants (60%) identified a social network as a “must-have”. 15 out of 21 participants (71%) agreed that a social network should be implemented in the chatbot to increase social support, 16 (76%) agreed to connect with others experiencing similar challenges, and 21 (100%) agreed to share helpful information (e.g., recommended physicians, behavioural therapies), as shown below.

> “It could be from [...] experiences say toilet training [...] or just advice on things or suggestions [...] It's like a social platform.”

> “[Y]ou get to meet new people. You get to learn about diagnosis, similarities in families, and that you're not alone.”

> “[I]n this app, it might be easier to connect people in a safe space to ask questions [...] the big thing is like feeling like you're not alone.”

14 out of 21 participants (67%) indicated that rules of participation and moderation must be in place to provide a safe space for parents. Comments from parents indicated potential for emotional discussion and regulation should be considered.

> “[O]pen format for people to put comments, it can get into a heated conversation. [A]n administrator has to administer it [...] if there's any language or anything inappropriate, that has to be taken out.”

> “[W]e're talking about a vulnerable sector, people are desperate to try something [...] There has to be some sort of filter or something that parents could get.”

> “There are some extremely controversial topics that do come up in these conversations, and that's when we need somebody else to police it. The easiest one to come up with is vaccination. It's a very divisive topic [...] It's extremely inflammatory conversations.”

> “[H]aving a report to admin button because with our kids, there are some great suggestions that parents give other parents but [i]t could be something very dangerous [...] because we've got [...] parents who are at the end of their rope.”

> “Advice that some parents give is actually dangerous as well. And when parents are at the end of their rope, they will try absolutely anything.”

Opinions differed among participants concerning whether medical misinformation or anecdotal evidence should be allowed on such a network. Some participants preferred having unfiltered information displayed (11/21, 52%), including anecdotal advice posted by other parents, controversial topics, and information that has not yet been validated by experts. These participants reasoned that they preferred seeing all controversial comments and ideas, and not being limited to only verified information. Conversely, others preferred being shown with only scientifically verified information (9/21).

> “[I]f it's posted there it needs to be validated [...] so the parents can see [...] it's been posted by the administrator, not by parents.”

Other major concerns included confidentiality, privacy, and security.

> “First thoughts are privacy and confidentiality and the ability to use a nickname within it so you don't have to use your real name or divulge my personal identifiable details.”
>
> “I'd probably want a little bit more anonymity than Facebook because [in] Facebook, I'm opting into [...] what I have revealed about myself [...] maybe, like demographics, like where you live, but not [...] the city [...] I don't think people need to necessarily, for the purpose of this, [...] know exactly who you are [...] That's a problem that would be nicely solved in the chatbot [...] You'd have much more liberty to ask questions in a safer space.”

Discussion

Principal Results

Our study revealed several informative points regarding the implementation of gamification elements in a chatbot supporting parents of children with NDDs. All parents were familiar with gamification and showed an overall positive attitude towards integrating it into the chatbot. This is important as such studies had not been conducted previously, despite NDDs having affected 3 to 18% of the population worldwide [1–3]. Our findings on goal-setting aligned with the findings in the literature, showing that parents preferred having a customizable “goal template” for behaviour management [28]. For the first time, our study showed that parents of children with NDDs found unlockable content deterring. This might be due to parents’ long journey of constantly pursuing information, which underlines the importance of adopting a UCD approach when developing a chatbot. It will be important to evaluate whether this is generalizable to other health domains. Our findings on social networking showed varied responses, indicating that this is a complex topic and highlighting the necessity of closely working with end-users when developing a chatbot for such a vulnerable population. Although some parents preferred being shown unfiltered information on social networks, which may contain medical misinformation, this would be challenging to implement as it could cause detrimental consequences to other parents and the medical community. The complex questions raised about social networking highlighted the importance of including users in the designing process of health-specific chatbots.

From our literature review, we identified five gamification elements that might be important in increasing user engagement in a chatbot designed for parents of children with NDDs: “goal setting,” “customization,” “rewards,” “social networking,” and “unlockable content.” From interviews and focus groups with 21 participants, we identified three main themes: 1) parents of children with NDDs were familiar with and had positive experiences with gamification; 2) goal setting was considered an essential feature for a chatbot for NDDs, whereas customization, rewards, and unlockable content received more diverse opinions; and 3) although social networking was viewed positively, it is a complex feature to implement due to the pertaining issues of medical fact-checking.

Our use of a combination of interviews and focus groups was primarily due to parents' limited availability. However, this allowed us to gain distinct information. In focus groups, we were able to elicit common opinions and attitudes to form major themes, while interviews provided us with detailed information and unique perspectives on the same topics [71]. In addition, consulting with parents of children with NDDs, or the intended users, provided unique insight into the reasons why some gamification elements were suitable. For instance, in the case of the social network, users mentioned that they would use this feature to identify other sources of information that may not be widely accessible online. The participants also warned about the potential negative impacts of emotional discussions on such sites.

Similarly, user consultation revealed an important aspect of creating NDDs-focused chatbots. While highly engaging in other spheres, unlockable content was overwhelmingly rated negatively. It was evident that withholding information from users, who described themselves as “desperate for information to help their children”, would be damaging. It remains unknown whether this remains true in other medical domains. To our knowledge, this is the first study about gamification and NDDs and one of the first about gamification in chatbots [41,72].

Limitations

Our study took place during the COVID-19 pandemic [73–75], which combined with the busy and fluctuating schedules of parents of children with NDDs [76–79], limited us to include only 21 parents. Additionally, the convenience sampling method may have introduced a selection bias to our study. To assess the generalizability and transferability of our findings, studies in different countries and with more variable social determinants such as sex, gender, socio-economic status, ethnicity and race, and age will need to be conducted in the future. Considering the unique vulnerability of the population interviewed, we refrained from pressuring any participant in responding to all questions. To obtain sufficient data, we included enough participants to reach a degree of saturation for each question. Based on our analysis, we were able to identify important themes with adequate certainty but would like to conduct further evaluation of the features identified as desirable in future prototypes or usability testings.

Conclusions

Knowledge mobilization remains a challenge in the medical domain [80]. This is especially true in situations of medical complexity such as public health or NDDs [81,82]. Parents of children with NDDs experience special social, medical and financial burdens which make it hard for them to remain engaged in usual knowledge mobilization tools. Gamification has been the subject of extensive research and interest, more recently in the medical field, and has been used for health professional education and patient self-management [83–85]. Chatbots have also been suggested to be used as a mental health assessment tool in the workplace [86].

Our study identified several gamification elements that should be used in a chatbot designed for parents of children with NDDs. As our recruited participants were all parents of children with NDDs, this sample could provide a representation of the population's responses. Recruiting parents of children with NDDs can be challenging considering their background (e.g., financial, and social pressure, complex demands from raising a child with NDDs). Nevertheless, understanding their perspectives is crucial to identifying gamification elements that would best suit their needs.

We showed for the first time that parents of children with NDDs support the use of gamification in a chatbot for NDDs. Our study illustrates the importance of adopting a UCD approach when determining the gamification elements needed to be included in a chatbot for NDDs. Some commonly used elements were perceived negatively by this specific group of users. Continuous incorporation of parents' feedback in the chatbot development will help create a better-received application that could bring positive impacts to these families' lives. Although there are many studies done on using users' feedback to improve health-centred technology, our study is the first to assess the potential reception of gamification elements to enhance the experience of users of chatbots in the health domain and more specifically in the NDDs domain. Using health chatbots in the NDDs domain is a practice still in its infancy.We believe that our work will help researchers in the same field gain a better understanding of this novel technology's design and applications. Future studies could include a prototype incorporating different elements of gamification, which could be correlated with their impact on usability and engagement.

Our study has two main implications: users’ perception towards five gamification elements, and potential application of such elements into a chatbot as an assistant tool for families living with NDDs. Participants have indicated that chatbot has a tremendous potential in educating users to increase their health literacy and better their care for special needs children. Their feedback and perception of the five elements will contiously guide us in our development of a prototype for this chatbot and conduct of future interviews/focus groups in the near future. Given our special targeted population, our results also shed light on the design of health chatbots for NDDs population, specifically to improve user experience and increase user engagement, which ultimately can improve their quality of life tremendously.

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Conflicts of Interest

The authors have no conflicts of interest to disclose.

Abbreviations

NDDs: Neurodevelopmental disorders
UCD: User-centred design

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Supplementary Files