Development of a casual video game (Match Emoji) with psychological well-being concepts for young adolescents

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Abstract

Digital interventions for mental health and well-being have been shown to be effective in trials, yet uptake and retention in real-world settings are often disappointing. A more significant impact may be achieved by building interventions that are closer to how target groups use technology to support their own psychological well-being. Casual video games may be poised to offer an opportunity in this area as they are a highly popular activity among young people. We propose that mental health content can be integrated into the explicit content and the implicit processes used in casual video games. In this paper, we describe the design and core processes of Match Emoji, a casual video game designed to support the development of psychological well-being via gameplay and micro-messages. The iterative development of Match Emoji involved various phases, including a systematic review of the literature, consultation with target users, clinicians, game developers, and close reading of the literature. Expert collaboration was sought throughout the process to ensure gameplay and messages matched behaviour change and learning theories. An acceptability and feasibility study of Match Emoji will inform a randomised controlled trial in the future.

Keywords

mhealth, casual video games, adolescents, smartphones, psychological well-being

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Introduction

Mental distress is common and appears to be increasing among adolescents globally.[1–3] Evidence-based interventions for depression, anxiety, and other disorders exist[4,5]; however, most of those with disorders do not get professional help,[6] and those who require less intensive support often receive no professional intervention.[7] Early intervention and promoting psychological well-being may support the development of personal resources so that young people can fully participate in society[8] and may prevent later psychological distress and disorders.[9] Early intervention is likely to be cost-effective; for example, The New Zealand Ministry of Health estimated that every $1 spent on preventing psychological distress and disorders saved $7 in health care and $30 in productivity costs.[10]

Digital technology offers scalable opportunities for mental health promotion and intervention. Computerised therapies, often based on cognitive behavioural therapy, are effective for treating anxiety and depression[11–13] and may have a role in preventing depression.[14] However, outside of trials, retention in computerised therapies has often been low.[15,16] In recent years, briefer apps optimised for smartphones have proliferated. Systematic reviews of apps highlight that some of these are likely to be helpful, but most have not been tested.[12,17] While a handful of apps appear to be highly appealing, with millions of

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downloads, many young people who might benefit from these do not access them.

Previous work

We set out to explore alternative opportunities and processes. Based on observations that adolescents often used the internet in their unmoderated ways to support their psychological well-being,[16] we wanted to explore opportunities to build on or capitalise on adolescents current online mood moderating behaviour, rather than beginning with adapting face-to-face models to online settings and asking users to adapt to those. We identified that 'unmoderated' internet use for mood or relaxation appeared to include the use of games, including relatively low-cost casual video games (CVGs). We carried out a systemic review of the literature related to the effects of CVGs on anxiety, depression, stress, and low mood.[18] From the 13 studies identified in the systematic review, 12 reported promising therapeutic effects of CVGs on anxiety, depression, stress, and low mood. The included studies highlighted potential pathways and opportunities afforded by CVGs, such as flow and high levels of engagement.

Next, we conducted a scoping study to explore young adolescents' views of CVGs and their opinions of CVGs with mental well-being concepts to help determine whether this idea was worthy of further investigation.[19] From the 207 participants aged between 13 and 15 years, many reported playing CVGs several times a week or day for various self-regulation purposes such as to help relieve stress or feel more relaxed. Participants were interested in the idea of a CVG with psychological well-being concepts. They provided recommendations such as using subtle psychological well-being content and creating an engaging interface with simple colours.

Following these promising findings, we aimed to develop a CVG to promote psychological well-being skills among adolescents aged 13 to 15 years using conceptual analysis of therapeutic mechanisms of change, opportunities afforded by CVGs, and co-design processes with young people.

Casual video games

CVGs are games that are fun, quick to access, easy to learn, and require no previous special videogame skills to play.[20] Typically, CVGs are developed based on traditional game formats such as Pinball and Tetris and adapted for use on digital technologies, including smartphones and computers. CVGs vary among dimensions such as goals, genre, and time commitments. They involve various mechanisms and skills to progress through the game. For instance, matching puzzle-based games such as 'Candy Crush'[21] involve lining up candies of matching colours to earn points and advance through the game.

According to The State of Online Gaming Report,[20] people play CVGs across demographics and report playing for various lengths of time and reasons. For instance, adults over 60 years of age report playing puzzle CVGs for extended periods of time and for social purposes. In comparison, younger adolescents such as those aged 13 to 15 years report playing CVGs 2–3 times a week in short bursts of time and prefer to play for reasons such as to relax and relieve stress.[19] The accessibility of CVGs, which can be played across devices and platforms at any time of day during various 'naturalistic' situations, such as waiting for a bus or stress-provoking environments, contributes to their increasing popularity. Although CVGs are the most popular game worldwide, their inherent therapeutic potential has not been fully understood to support psychological well-being.

Theoretical underpinnings

Based on the literature review and initial youth consultation, we proposed that CVGs offer flow, immersion,[20] and brief mood-enhancing distractions or a release from unpleasant experiences.[18] Many CVGs include advertisements and prompts to purchase greater gameplay options and increase game spending. We proposed that immersion and focusing might be harnessed for mental well-being purposes by including additional prompts through micro-messages to help the user slow down and notice what is happening internally and externally. It is hypothesised that helping players focus their attention and change cognitive processes will enhance their mood and be generalised to other environments.

CVGs can support the learning of new ideas and the integration of concepts and behaviours.[21] We theorised that some groups of adolescents are open to learning psychological well-being concepts and ideas if presented in a simple and engaging way, for example, short micro-messages about simple skills coherently included in a CVG.[19] We proposed that adolescents use CVGs despite advertisements. As such, replacing upgrades or in-game advertisements might be a novel and engaging idea. While there is little literature in this area, other researchers have supported the idea of brief micro-interventions.[5] The acceptability and face validity of very brief mental health was supported by our early youth engagement, where this linked to the gameplay experience.[19]

Study aim

Based on the literature review and youth interest, we aimed to develop a CVG to promote psychological well-being among adolescents aged 13 to 15 years. We utilised cultural, academic, and game development expertise throughout the design and development process. This paper discusses the design features and psychological and

behaviour change processes of Match Emoji that aim to promote psychological well-being skills among young adolescents.

Methods

To design Match Emoji, a CVG with psychological well-being concepts, we used a participatory design framework involving the active participation of target users across each phase of development.[22,23] This versatile and iterative design approach was supported with multi-disciplinary collaboration from international digital mental health experts at key stages of development. The in-depth consultation was a strength of the design process as it allowed us to refine critical ideas such as the content involved in the micro-messages and ensure there was an optimal balance between psychological well-being skills and engaging gameplay.

To support re-developments and refining of Match Emoji during each phase, we consulted with a small and interested group of between 5 and 7 young adolescents. The small group of key informants expressed initial interest in the game following a presentation to a secondary school form class with 13- to 15-year-old. Although small in size, the key informants provided insight into the design and development of the images, script, and dynamic message loading system. We employed different methods when consulting with the group to elicit feedback, such as focus groups and think-aloud interviews. Multiple methods helped to utilise diverse participants' skills and characteristics and ensured they felt comfortable sharing their thoughts and opinions. This led to a more productive design process. For example, through think-aloud interviews with key informants, we found that advertisements in CVGs were a common barrier to engagement as they were time-intensive and not relevant to the game. Subsequently, we replaced advertisements with short psychological well-being micro-messages that matched gameplay. Conversely, some participants preferred to provide honest feedback about the look and feel of the game in focus groups. This feedback helped to identify appropriate colours for the images.

Phase 1: Preferences towards CVG genres

Building upon the systematic review and scoping study results, we conducted in-depth consultation with 13- to 15-year-old adolescents to identify preferences towards CVG genres. As many different types of CVGs exist, we sought to understand which type of game was most popular. Consistent with previous research[16] target users had diverse preferences. For example, many preferred simple match-three CVGs that require users to line up tiles or candies to earn points. In contrast, other adolescents preferred puzzle games such as Sudoku. Although preferences for CVGs among young adolescents varied, match-

three games appeared to be the most popular type of CVG among 13- to 15-year-old.

Phase 2: Design and development of match emoji

Following phase 1, we aimed to create a new engaging CVG with psychological well-being concepts. However, given the typical budget of a CVG can vary from $10,000 to over $100,000,[21] we engaged a software developing company to identify how best to use the available funds. After initial collaboration with software developers and target users, we decided to purchase a popular modifiable match-three game similar to 'Candy Crush'.[20] By purchasing an existing CVG, we were able to maintain engaging gameplay features, with minimal development cost, while being able to integrate psychological well-being concepts and ideas from target users.

To replace images and advertisements in the game, we used an agile design process involving collaboration with experts and consultation with behaviour change and learning theories. Once iterations had been created, we tested Match Emoji in a series of cycles known as 'sprints' with target users.[24] Through the design process, we formulated micro-messages to replace advertisements in the game. These messages were based upon a combination of psychological well-being theories. The two primary theories involved were the Five Ways to Wellbeing[25] and the Discoverer, Noticer, Advisor and Values (DNA-V) model of behaviour change.[26] The Five Ways to Wellbeing are simple daily practices for individuals to improve their well-being that include connect, be active, take notice, keep earning, and give. The DNA-V model aims to support adolescents in managing emotions, connecting with their values, using mindfulness, and developing healthy relationships.[27] Although all core processes of each model were not used within the game; both theories provided a basis for formulating messages as both theories are culturally and developmentally appropriate for young adolescents in New Zealand.[25–28]

The micro-messages were checked with experts who had knowledge of the behaviour change models and were changed accordingly from their feedback. Following the development of micro-messages, images were created for each message and key aspects within the game. For example, Emojis were created to replace candies. Throughout each sub-phase, we were able to consult with a well-defined group of young adolescents who were familiar with CVGs and interested in playing Match Emoji. This consultation enabled quick feedback to be obtained to shape the development of the game.

Match Emoji

The goal of Match Emoji is to match similar coloured emojis together to earn points and progress through the
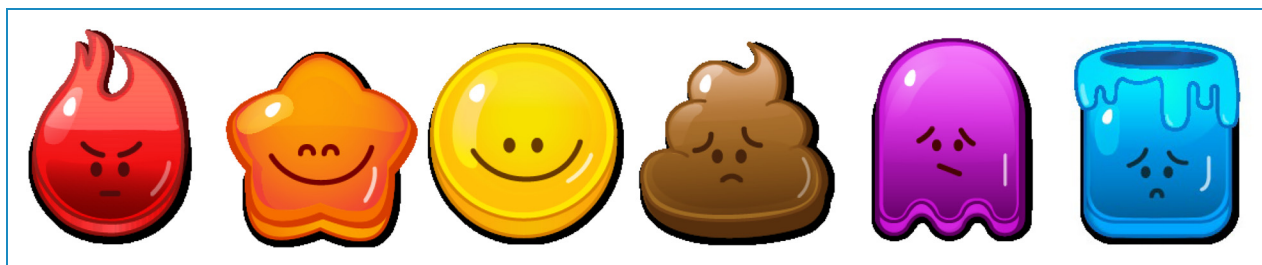
Figure 1. Emojis.

game. The six different coloured and shaped emojis in the game as seen in Figure 1, represent digital expressions of emotions, ideas, and personality.[29] After the user has successfully matched the required number of emojis, which can last from 30 s to over 3 min or, has failed to match the required emojis in the time limit, a micro-message appears on the screen. Each micro-message is delivered via a dynamic messaging loading system that helps to identify the 'optimal' time to display the message. Hints are used throughout the game if players get stuck. For example. if the player waits too long before making a move, Match Emoji identifies a potential combination of similar coloured emojis by moving a successful sequence of items back and forth to capture the user's attention. As the game progresses, users are required to Match Emoji in a fixed amount of time and identify different combinations with special types of emojis. Therefore, although hints are useful at the beginning of the game, they may not necessarily be the best option as the game progresses. Figure 2 illustrates a typical gameplay session.
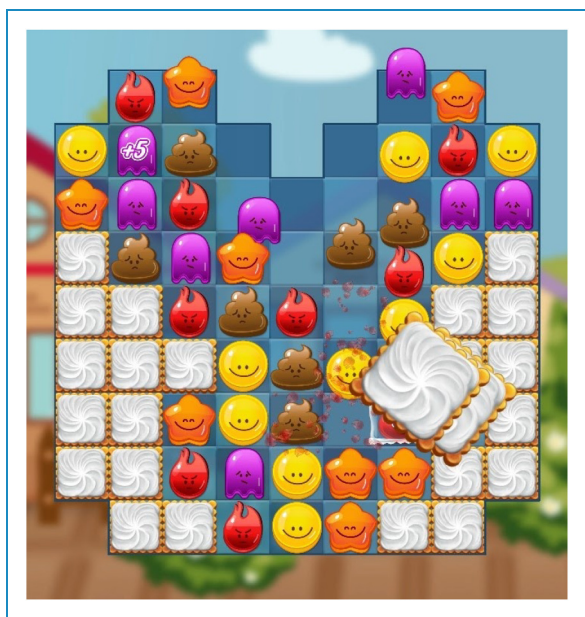

Figure 2. Game play.

The following section details the design features and psychological and behavioural change processes of Match Emoji.

Script for micro-messages

The original CVG purchased used advertisements in the form of short videos after each level. Through multidisciplinary collaboration and preliminary interviews with young adolescents, we decided to replace advertisements with micro-messages. The initial script for the micro-messages was formulated by the first and last author (RP and TF). The script was adjusted accordingly from feedback obtained in the form of qualitative interviews with key informants. Recommendations involved suggestions such as 'Provide a light level of mental health content' and 'Do not be heavy handed on the messages'.[19] 'I like the noticing character but needs a cool image' and 'the simple 5 tips thing seems like you could actually do them pretty easily'.
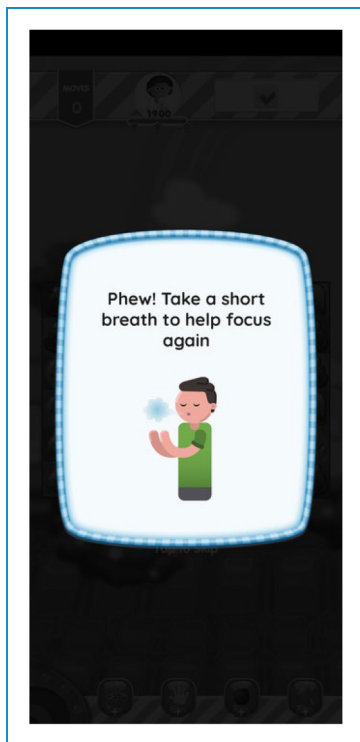
Psychological well-being literature, specifically the Five Ways to Wellbeing and the DNA-V model, was referred to support the development and refining of the script. We consulted with international digital mental health experts and psychologists to seek their professional opinions and ensure the script included the optimal balance between engaging gameplay and psychological well-being content. An example of four micro-messages can be seen in Table 1 with a screenshot of how the micro-message appears in the game in Figure 3.

Dynamic message loading system

Software developers created a dynamic message loading system to enable micro-messages to be stored, retrieved, and modified on a secure platform. This system provided an opportunity to rapidly test the delivery of each micro-message with target users and quickly incorporate feedback from experts and the literature. For instance, target users could provide feedback on the preferred length of time a certain message was displayed on the screen. Once the optimal amount of time had been identified, and the system created the change, the adjustment appeared in

Table 1. Script for Match Emoji.

Welcome to Match Emoji a simple matching game to help relax the mind
Sometimes things suck and it affects our well-being
We might feel like poop sometime or we might feel great!
Doing something simple like talking to a friend can uplift our mood

Figure 3. Example of micro-message in the game.

Match Emoji after an internet connection was established. It is important to note that an internet connection is only required to download the game and the most recent changes from the dynamic loading system. The following features contribute to the dynamic loading system and can be seen in Table 2.

Identification number: A unique number given to each micro-message.

Micro-message: The micro-message delivered in the game consists of between 4 and 15 words.

Type: Each micro-message is split into two categories: concepts that involve messages related to psychological well-being, or game events that are related to how the user is currently engaging with the game, for example, how many wins or loses they have had.

Set: A series of closely related messages that have a similar learning objective. There are nine sets of messages within Match Emoji.

Pause: Length of time the message is displayed on the screen for in seconds. This ranges from 5 to 15 s.

Images

After the micro-message and dynamic loading system were created, we engaged a design expert to create images for the game. The design expert worked closely with the multidisciplinary team to ensure images aligned with the purpose of micro-messages, the current aesthetics of the game, and the overall objectives for each message set. Frequent meetings with the design expert were involved in enhancing the iterative process and in clarifying goals. Mock images were checked with key informants to ensure images matched target users' preferences as seen in Figure 4.

Flow

Flow is a state of dynamic equilibrium which occurs when a challenge is equal to the individual's skill level.[30] When

Table 2. Dynamic message loading features.

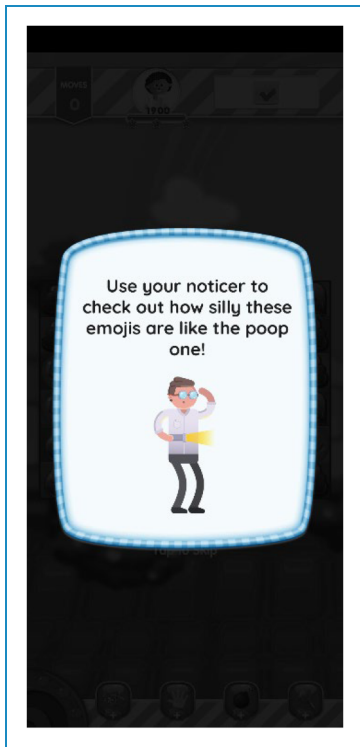| Sequence number	Micro-message	Type	Set	Sequence	Pause
26	Phew! Take a small breath to help reset and try again.	Concept	4	6	7
27	Nice job you are getting the hang of this!	Game event	4	7	5
28	Now notice what your mind says after you win a level!	Concept	4	8	5
29	Welcome back to the game did you use your discoverer and try something new?	Game event	4	9	5

Figure 4. Character created for Match Emoji.

applied to CVGs, research suggests this type of game is ideally poised to produce a state of flow – challenge, clear rules and goals, immediate feedback, and the ability to increase in difficulty.[31] Match Emoji uses this mechanism by matching the users' skill level with the presented challenge. This involves increasing the difficulty of matching emojis to align and challenge the user's skill set. For instance, after users have been able to successfully navigate the challenges presented in the first five levels, players are required to match similar coloured emojis under a time constraint. This time constraint forces the player to try different strategies and make more complex decisions to advance through the game.

Learning theories

Each micro-message in Match Emoji is assigned to one of nine different message sets. Each message set has a series of specific learning objectives that gradually increase in complexity. For instance, the first set of micro-messages aims to orientate players to the game and normalise difficult thoughts and emotions. As players progress and learn psychological well-being skills, they are encouraged to try skills during the game. For example, users are asked to notice what is happening around them or within their bodies when they lose a level. Concepts learnt in one section of the game are used later in the game with others or on a subsequent level to support the learning of psychological well-being skills.

Spacing and interleaving key ideas require more effort from the learner to recall previously encountered information in the game.[32] However, the more cognitive resources required for the learner to retrieve information, the more likely this information is stored in their long-term memory.[33] An example of interleaving and spacing psychological well-being skills within Match Emoji is 'Sometimes taking a slow breath can help chill us out'. In subsequent message sets, users are presented with 'Phew! Take a small breath to help reset and try again'. This message is also displayed on the screen for a longer period to allow the user to practise the skill of breathing slowly.

The gap between one's current skill level and potential skill level is known as the zone of proximal development (ZPD).[34] Learning opportunities that align with an individual's current skill level, known as scaffolding,[34] facilitate development through the ZPD. The ZPD and scaffolding align with the mechanisms that underpin Match Emoji. For instance, during the first 10 levels, players encounter simple concepts to match young adolescents' current knowledge of psychological well-being skills. These short messages provide the building blocks for more complex learning in subsequent message sets and levels. Images, reminders, and challenges provide scaffolding and facilitate the progressing of learning through the ZPD and the game map as seen in Figure 5.
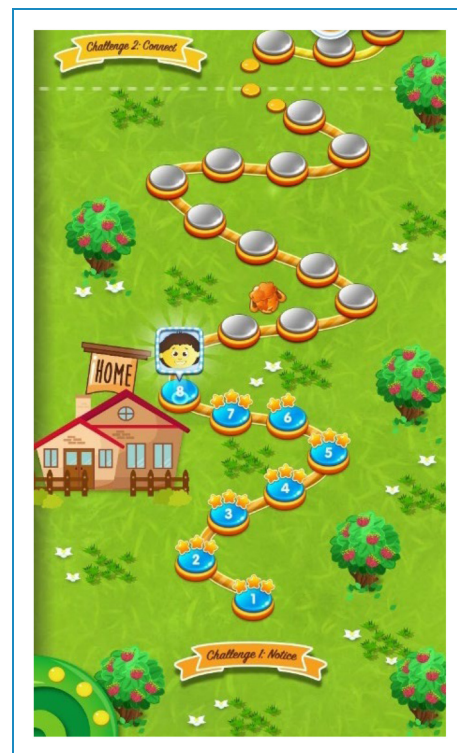

Figure 5. Game map.

Discussion

Overall, We have described the design features and psychological and behaviour change processes of Match Emoji, a CVG designed to support the development of psychological well-being via gameplay and micro-messages. The iterative design involved participatory design procedures with young adolescents and multi-disciplinary collaboration with software developers, designers, health professionals, and digital mental health experts. A systematic review of the literature and scoping study of target users' preferences supported the emerging rationale for a CVG with psychological well-being content.

Strengths

The agile design approach adopted to create Match Emoji involved several strengths. First, target users provided valuable input into key design decisions across the entire design process. For example, the design expert created mock images for the character and emojis. These images were checked with a small group of target users who provided their opinions and preferences on the aesthetics. From this feedback, we were able to work collaboratively with the design expert to create the necessary adjustments and ensure images were engaging. Slattery et al.[35] suggest that involving target users in the design of health interventions should be standard procedure. This is because researchers can better understand users' needs, create a more engaging intervention, and continue educating end-users about future interventions.[24,36] We found that actively involving and consulting with 5 to 7 young adolescents was beneficial for obtaining focused and genuine content. By integrating feedback from target users we hope to improve the likelihood of engagement with Match Emoji in 'real-world' settings.

Another strength to the development of Match Emoji involved the input from key stakeholders and experts at multiple stages. Multi-disciplinary consultation enabled us to seek expert guidance across various domains. For example, iterations in the code for Match Emoji were handled by software developers while mental health practitioners provided input into the content and purpose of each message. The benefit of adopting this design approach allowed us to quickly navigate challenges and meet tight deadlines for each sub-phase of work. This ultimately facilitated the development of images, micro-messages, and a dynamic messaging system. A growing amount of research has highlighted the essential role multi-disciplinary collaboration plays in the design of digital mental health tools.[37,38] This is in part, due to the various skill sets that are required to work towards the same mutual goal. Collaboration with key stakeholders is therefore fundamental for a well-designed and executed health intervention.[39]

From the initial stages of the project, we sought to create an intervention that closely related to how 13- to 15-year-old currently use technology to support their own psychological well-being. Consistent with research, we found smartphone usage was high among young adolescents and was most often associated with playing CVGs. For instance, the average smartphone owner uses ~10 apps per day and 30 apps each month.[20] With smartphone users typically dipping in and out of apps, many users are unlikely to engage with digital health interventions that are time-intensive. In fact, systematic reviews and user analytics suggest many digital mental health tools have limited uptake after they have been downloaded.[17] Considering the most downloaded category of apps are games, specifically CVGs, we thought this might be an appealing mode of engagement.[20] As such, we used the idea of CVGs with behaviour change and learning theories to create a short micro-message centred around simple psychological well-being skills. Because content is highly focused and the time frame for playing the game is shorter than typical digital mental health tools,[40] it is possible this may create a digital mental health tool that fits with how people currently use technology.

Limitations

We consulted with target users throughout each phase of the design and development process. During the first phase of development, we consulted with over 200 young adolescents across seven different schools. This large-scale consultation provided valuable input into the type of CVGs and prototypes; however, as individual classrooms involved between 20 and 30 students, we often obtained conflicting feedback and suggestions. In a recent rapid review of co-design approaches in health, Slattery et al.[35] suggest there is a paucity of research on the effects of group size on co-design interventions for health. Further, guidelines have yet to be developed around the ideal group size for focus groups and co-design workshops. Nevertheless, small and frequent consultation with end-users is often recommended to fully understand users' preferences.[24] Therefore, we adjusted our methodological approach in subsequent phases of the project and consulted with a smaller group of young adolescents.

When we embarked on developing Match Emoji, we were mindful of the potentially addictive functionalities games use to engage users for long periods. There have been several studies exploring the potentially aversive and addictive qualities of games.[41,42] When people spend a large part of their day gaming, this pattern of behaviour can increase the chances of experiencing problems with peers and demonstrating aggressive behaviours.[43] Spending large amounts of time gaming or on screens can become excessive when it replaces healthy behaviours such as physical activity and sleep; however, the World Health Organization[44] recently

provided guidelines for the usage of technology. These guidelines suggest it is important to use technology that involves playing games in 'moderation'. It is also particularly important to ensure the young person's safety online. As Match Emoji is a CVG played off-line and designed to be played for 5 to 15 min at a time, the game appears to be a suitable match with current technology guidelines. Further, we did not include functionalities that are associated with more harmful and addictive aspects of gaming, such as violence, compulsion loops, or online features. These functionalities were excluded from the design to ensure users engage with the game as it is intended for – short 5 to 15 min sessions at a time.

Next steps

Our next steps are to conduct an acceptability and feasibility study of Match Emoji with young adolescents in New Zealand secondary schools.[45] Information from this study will provide feedback into the design and functionalities of the game and potentially inform the design of a more robust evaluation approach such as a randomised controlled trial.

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