

Playing with emotions

Report on the Healthier Hackney's 2015 grant for BfB Labs' emotional regulation video game

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Introduction

It is estimated that one in four people in the UK experience some form of mental health condition¹ and that half of all cases start by age 14.^{2,3} Mental health problems also disproportionately affect those in poverty. Hackney was the eleventh most deprived local authority overall in England in the 2015 Index of Multiple Deprivation⁴ and based on average ranking of local authorities, Hackney ranked as the second most deprived LA in the country.⁵ Statistically, therefore, young people in Hackney have high levels of vulnerability to mental health problems.

Recent research indicates that difficulties in regulating emotions lie at the heart of many common mental health problems.^{6,7} There is thus a strong argument for preventative interventions that build emotional regulation skills in adolescents.

Most current preventative solutions that provide training in emotional self-regulation, such as mindfulness meditation or therapy, can be inaccessible for young people, both in terms of finding out about the support available and being able to afford it. It is also not part of mainstream youth culture, with connotations of being “alternative” or “hippy”, whilst also carrying the stigma that still exists around mental health issues.

One simple preventative solution that is known to be helpful in regulating emotions is diaphragmatic breathing. The beneficial effects of stand-alone regulated diaphragmatic breathing have been widely recognised within the medical field and it is recommended as a relaxation technique by health organisations including the NHS⁸, Bupa⁹ and the mental health organisation MIND¹⁰. Although effective, it is often difficult to engage young people in this technique due to it being simple and relatively monotonous.

1 Mental Health Foundation (2007) The Fundamental Facts: The latest facts and figures on mental health. London: Mental Health Foundation. **2** Kim-Cohen J, et al. (2003). Prior juvenile diagnoses in adults with mental disorder: developmental follow-back of a prospective-longitudinal cohort. *Archives of General Psychiatry* 60(7):709-17. **3** Kessler, R., et al (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the national comorbidity survey replication. *Archives of General Psychiatry* 62(6):593-602 **4** LB Hackney Policy Team (2016) A Profile of Hackney, its People and Place **5** Hackney Council (2016) Indices of Multiple Deprivation 2015 – On the Day Briefing **6** Gross, J. J. and Muñoz, R. F. (1995), Emotion Regulation and Mental Health. *Clinical Psychology: Science and Practice*, 2: 151–164. **7** Berking, M. and Wupperman, P. (2012) Emotion regulation and mental health: recent findings, current challenges, and future directions. *Current Opinion in Psychiatry*, 25(2):128-34 **8** NHS (2014) Relaxation tips to prevent stress from www.nhs.uk/conditions/stress-anxiety-depression/pages/ways-relieve-stress.aspx **9** Bupa (2014) Stress from www.bupa.co.uk/individuals/health-information/directory/s/hi-stress?tab=FAQs **10** MIND(2012) How to manage stress from <http://www.mind.org.uk/media/977061/how-to-manage-stress-2012-2-.pdf>





To overcome this barrier to practice, BfB Labs has developed an enjoyable, rewarding video game that uses heart rate sensors to generate biofeedback which helps young people understand the effect their breathing has on their heart rate and subjective feelings of stress. The tablet-based game creates a feedback loop which

links good diaphragmatic breathing, a core behaviour in regulating emotions, with progress in the game. By ensuring the game is fun and engaging it encourages young people to play regularly, building up, and gradually internalising, the positive habit of using regulated breathing when stressed, anxious or under pressure.



Aims of the project

Aims

As part of the Healthier Hackney grants, Hackney council provided BfB Labs with a grant to roll out our game to young people living in the borough.

We aimed to establish relationships with at least two organisations that worked with young people in Hackney, and through these facilitate regular play sessions of our game for 40 young people. Specifically, the young people would need to play the game three times a week, for four to six weeks.

As part of this project we also wanted to provide training to the organisations' staff to equip them with the information and skills to run the play sessions themselves and gather data on the progress of the young people playing.

Intended impact

We hoped to build the young people's skills of emotional regulation through regular practice of diaphragmatic breathing, in the context of the game. This, in turn, would increase their confidence and wellbeing, as well as providing them with a technique that they could use to regulate their emotions in difficult situations outside of the game context.

By gathering young people's feedback on the game we could also continue to improve it, ensuring it is as effective as possible at teaching and encouraging this emotional regulation technique.

Finally, by working with organisations in contact with young people we would better understand the different ways in which our game could be integrated within different educational and youth work settings.



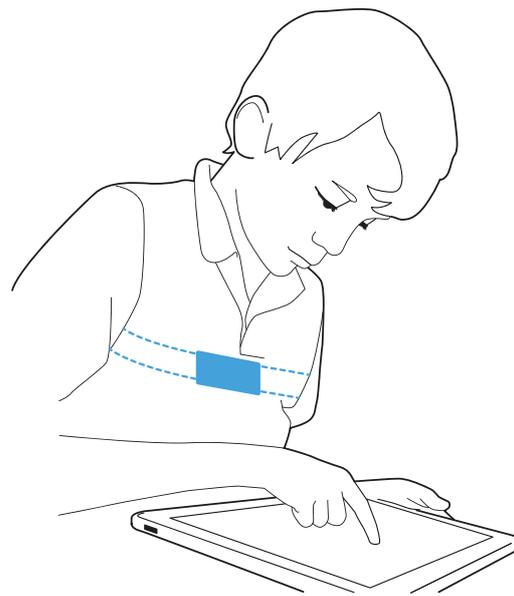


The Game

How the game works

Regulated breathing is a key physiological self-regulation technique; an accessible and easy-to-understand way to calm down¹¹ and there is now a large body of evidence showing that regulating the speed and physical movement involved in the breath can directly reduce physical stress reactions in the body,¹² making it a powerful tool in the management of stress and anxiety.

One type of breathing which has been found to be particularly effective in reducing stress and managing anxiety is diaphragmatic breathing, where the diaphragm contracts and air is drawn into the bottom section of the lungs.^{13,14} Regulated, diaphragmatic breathing has been shown to activate the parasympathetic nervous system, the system that calms the body down by promoting the “rest and digest” response^{15,16}, and counters the “fight and flight” response. The beneficial effects of stand-alone regulated diaphragmatic breathing have been widely recognised within the medical field.^{17,18} BfB Labs, therefore, harnessed the power of video games, which are ubiquitous among our target audience and designed specifically to motivate repeated practice, and used these traits of video games to encourage the learning and regular practice of this breathing technique.



The game is played on an android tablet and connects to a monitor that measures the player’s heart rate. All breathing has an effect on heart rate and so using an algorithm the game is able to detect how well the the player is doing diaphragmatic breathing. The better the player is at the breathing technique, the more points they receive in the game, incentivising the learning and practice of this technique.

11 Everly & Lating (2013). Voluntary control of respiration patterns. A Clinical Guide to the Treatment of the Human Stress Response. London: Springer.
12 McCaul, K., Solomon, S. & Holmes, D. S (1979). Effects of paced respiration and expectations on physiological and psychological responses to threat. *Journal of Personality and Social Psychology*, 37(4), 564-571 **13** Gilbert (2003). Clinical applications of breathing regulation: Beyond anxiety management. *Behaviour Modification*, 23(5), 692-709. **14** Hazlett-Stevens & Craske (2008). Breathing retraining and diaphragmatic breathing techniques. Ch.10 in *Cognitive Behavior Therapy: Applying Empirically Supported Techniques in Your Practice* / Edited by William O’Donohue & Jane E. Fisher. Wiley. **15** Harvey, J. (1978). Diaphragmatic breathing: A practical technique for breath control. *Behaviour Therapist*, 1, 13-14. **16** Ballentine, R. (1976). Science of breath. Glenview, IL: Himalayan International Institute **17** NHS (2014) Relaxation tips to prevent stress from <http://www.nhs.uk/conditions/stress-anxiety-depression/pages/ways-relieve-stress.aspx> **18** Bupa (2014) Stress from <http://www.bupa.co.uk/individuals/health-information/directory/s/hi-stress?tab=FAQs>

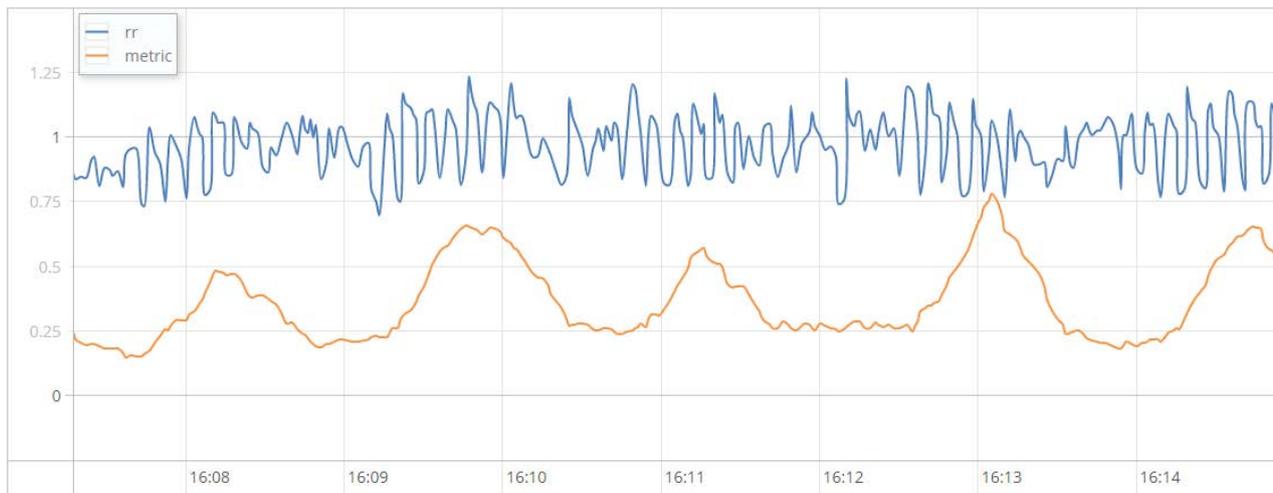


Data from the game, including game-play metrics and heart rate related data, is captured and stored on a password protected and encrypted Trial Manager database. The screenshot below shows the heart rate data visualised by the Trial Manager, with the bottom line (orange) showing the score in the game, and the

top more jagged line (blue) representing a measure of heart rate. When the waves in the top line increase in amplitude (curve height) this shows that the player is breathing diaphragmatically in the game, and their game score is therefore increasing.

Diagram 1: HRV data

Show results for: 5th November 2015 ▾



Game theme and design

The game is a digital card duelling game that casts the player as a powerful spellcaster competing for fun and glory in a worldwide magical duelling championship. During the trial it had a working title of Magic School.

The game version used in the trial had three sections:

Ranked match:

A competition in which the aim was to get your opponents health down to zero before they managed to do the same to you. You reduced your opponent's health by playing different types of cards against them.



In each round of every match there was a section where the player had to focus on their breathing, following a breathing pacer. In this version of the game it was a blue gem which increased and decreased in size to indicate when the player should inhale and exhale (see picture inset). Points were given based on how well the player does the diaphragmatic breathing, and they could then use these points to increase the power of their attack on their enemy or defence of themselves.

The Proving Grounds:

A training area in which the player was able to build their skills in diaphragmatic breathing. They were given breathing-based challenges and if they succeeded they won new cards to use in their ranked matches.

Spellbook:

A book that displayed all of the cards the player had got in their deck, including the additional cards they had won. These cards were then used in the ranked matches they played.





The project

Initial user testing

At the start of the project, we conducted user testing of the game with young Hackney residents.

We conducted four user testing sessions at the Forest Road Young Hackney youth club, ran a user testing sessions facilitated by the Hackney-based charity Immediate Theatre, and had a stall at the Hackney Youth Parliament Youth Conference, 2015. Across these sessions a total of 16 young people from Hackney played the game.¹⁹

Based on the user testing we made a number of refinements to the explanation of the game and the mechanisms within it before rolling out the game to the groups of children within the trial.

During these user tests we explored:

- Players' comprehension of the game and rules.
- Players' understanding of our explanation of the breathing technique, and how this could be refined and improved.
- The clarity of the feedback mechanism that showed how well the breathing had been executed in the game.
- The general appeal of the game, and its magic theme.

¹⁹ We also ran some user tests with a London-based youth club, in the London Borough of Lambeth.





The project

Roll-out of the game

Schools involved

We worked with two primary schools in Hackney to roll out the game to 58 pupils who would play the game for 20 minutes, three times a week for four weeks.

Morningside Primary School

In Morningside, the gameplay sessions were run as a whole class activity, with one Year 5 class (9 - 10 years) and one Year 6 class (10 - 11 years) being selected to play the game.

Queensbridge Primary School

In Queensbridge, the game was played as a small group intervention. Six students were selected from Year 5 and were taken out of lessons to play the game during the four week period.

Design of the intervention

Before the sessions began

To ensure that staff members would be able to run the play sessions independently within the school day we ran staff briefings with staff in both schools. These included an explanation of the diaphragmatic breathing technique and how to teach it, how to use the game equipment, the rules of the game and how to access the online Trial Manager database to review the progress of their classes. A staff instruction guide was also provided.

To quantitatively capture any impact of the game we gave the young people two surveys before they started the four week period: the [Strengths and Difficulties Questionnaire](#) (SDQ), to measure wellbeing, and an emotional regulation survey, the [Difficulties in Emotion Regulation Survey](#) - 16 item (DERS-16).

During the four week play period

During the play period the groups played the game for at least 20 minutes, three times a week for four weeks. The lead staff at the schools were able to decide when in the school day and week they wanted to run the session. We only asked that no two sessions were run on the same day.

In the first session at each school, the game was introduced by the BfB Labs team, who also gave an introduction to the breathing technique and were then on hand to provide support and answer any questions. In this introduction we purposely didn't include any explanations of the applications of the breathing in real life, e.g. being able to retain composure during an argument, as we wanted to see what the young people independently took from the game in terms of messages, skills and applications to real life.

The following sessions were run by the School staff with BfB Labs staff being present at some sessions as additional support.

In every session, the gameplay and heart rate data for each player was digitally collected by the Trial Manager database. The staff running the trial could log in to the Trial Manager and see the progress of their classes, or individual players within their classes.

After the four week play period

At the end of the four weeks of play, the groups completed the wellbeing and emotional regulation survey once more, and also filled in an engagement survey capturing information specifically around game play and how much the groups had enjoyed playing.



We also conducted five focus groups with the young people and conducted in-depth interviews with staff involved in running the sessions at both schools.

Analysis methods

Qualitative analysis: The focus groups and staff interviews were notated and then analysed thematically.

Quantitative analysis: For the wellbeing and emotional regulation surveys, we analysed the difference in pupils' scores between the before and after surveys, using a paired samples t test. For various reasons the Year 6 Morningside class had a low completion rate of these surveys and consequently were excluded from this analysis. Analysis was conducted on the Morningside Year 5 and Queensbridge pupils who had completed both the before and after surveys (n=27).

The engagement surveys were completed by all students and analysed by class and school. Results included surveys from Year 5 & Year 6 Morningside and Queensbridge (n=51).





Results

Player numbers

Overall we had a total of 83 young people who played the game during this period, 74 of whom were from Hackney²⁰ and 58 of whom played regularly for four weeks. This exceeded our initial target of 40 young people playing regularly. We also briefed six members of staff on the game, resulting in a total of 89 people being reached by the project, compared to our stated target of 42 people.

Experience of playing the game

Children enjoyed the game

Video games are fun, and designed to encourage players to play repeatedly to continue to experience this fun. It was, therefore, fundamental that our game was found to be fun in order to encourage regular play, and practice of the breathing technique.

We found this to be the case in the trial. Over three-quarters (76%) of the students who played the game said they enjoyed it, with another 16% remaining neutral, and nearly three quarters (73%) said they would recommend it to a friend. Considering this was a mixed gender class with a mix of gaming experience and preferences, these high percentages were particularly encouraging.

Within the focus groups we also received mostly positive feedback, with one group of boys even having searched for the game on the Google App Store to download outside of school. Most children had clearly engaged with the game, the rules and the tactics, giving specific

ideas on how to improve the game play. Staff feedback supported this view with reports of some children asking when the next play session was, and if they could catch up on sessions they had missed.

The strongest negative feedback we received was on technical glitches in the game, which we had anticipated, with the game being at a beta stage. These were felt to interrupt the game play which could be frustrating. There were also some complaints about connection issues between the game and the hardware which we had also expected and are currently exploring different hardware solutions.

Breathing enhanced game

The idea of having breathing in the game was felt to make the game unique. This uniqueness increased the appeal of the game, made the children feel more involved in the game, and made it more interesting to play. A few children spontaneously mentioned the breathing when asked what their favourite thing in the game was.

“The breathing’s quite fun. It’s quite unique. It’s a new experience. It’s also pushing yourself. Without the breathing, it would be nothing. It would be like a luck-o-meter”

Pupil in focus group

²⁰ We ran user tests with 9 students at a youth club in the London Borough of Lambeth



Impact of playing the game

Children spent considerable time practicing their breathing in the Proving Grounds

When asked what they liked about playing the game many of the children spontaneously said they had enjoyed the Proving Grounds. The reasons given for this were twofold. Firstly, they could earn new and better cards, which could only be unlocked in this section, with the surprise of which card you would earn for a challenge being the major draw. Second, some young people liked the time it gave for concentration on the breathing and trying to improve their technique, and therefore their score in the game. Irrespective of their motivation, time spent in the Proving Grounds was time spent practicing the breathing technique, building their ability to regulate their emotions using this technique.

Whilst observing play sessions we also saw some young people developing their own techniques for concentrating on the breathing technique during the game, such as covering the score marker with their hands so they didn't know how many points they had until the end of the breathing section. They were doing this to reduce the anticipation and mental tension associated with their scores rising or falling, demonstrating that the game had encouraged them to make the connection between their mental state and their ability to stay calm physiologically.

Most children had improved their breathing technique

The game aims to encourage regular practice of diaphragmatic breathing, but also to improve the players' breathing technique. 78% of the children felt they got better at doing the breathing during the 4 weeks, and 82% felt they got better at playing the game, which by necessity would involve improving their technique, along with their strategic play.

When asked about their breathing technique in the focus groups some of the young people said they found it quite a difficult thing to do, but most felt they had improved by the end of the four weeks. For some, the game became more fun over time because they improved their technique, and so could earn more points, buy better cards and have more chance at winning the game.

“When we started, we didn't really win a lot but later, we were winning.”

Pupil in focus group

Initial difficulties with learning the technique were partly caused by difficulty understanding the breathing pacer, and not realising they were able to change the speed of the pacer. Based on these findings both of these game elements are now being worked on by our team for the next version of the game.

The feeling experienced after the game varied among children

When asked how they had felt after playing each session, some children felt the same, some felt tired from the breathing and some felt more focused. Within the Queensbridge group we explored these feelings further, and the children explained that they could feel calm from the breathing, but this was balanced with excitement generated by the game e.g. having won a match, or earned a good card. Where they were in the game when the play session ended could determine if they felt calm or excited at the end of a session.

Some children had already used the technique of breathing outside of the game

When asked if they had used this technique outside of the game a few of the children explained that they had used it to manage their emotions in stressful or emotionally charged situations, in line with the aim of the project. They had used it in scenarios with their families, for example when their sister had taken something of theirs, or when their mum was annoying them.

“I used [the breathing technique] when my sister took something of mine that was private and then I used my breathing and said ‘it's ok' because it didn't really mean anything.”

Pupil in focus group



“When my mum annoyed me I got angry then calmed myself down with breathing.”

Pupil in focus group

The game engaged students who sometimes struggled with concentration

Within the small group in Queensbridge some of the students had been selected as they had anger, anxiety or concentration difficulties, and all of these students engaged with the game and focused on it.

Within Morningside, where the game sessions were run as a whole class activity, the Year 5 teacher felt that the children that struggled with behaviour and routine may have particularly enjoyed it, engaging intensely in the play sessions. She suggested it may be due to an element of control and instant gratification provided by the game. This has prompted us to further investigate the use of the game with Pupil Referral Units where the majority of students have behavioural difficulties.

There were no significant changes in wellbeing scores in wellbeing scores

There were no significant changes in the SDQ or DERS-16 surveys from before to after the play period. Within the Queensbridge group there was a slight improvement in the two scales, and in the Morningside group there was a slight worsening of these two scales but neither were statistically significant (meaning that the changes could have been caused by chance).

The two scales we chose (the SDQ and DERS-16) were both validated scales, of an appropriate length, and suitable for the age group. However, measuring wellbeing and emotional regulation within a normal, non-clinical, population is accepted as difficult and widely used wellbeing scales, like the ones we chose, are not always sufficiently sensitive and can also be unduly influenced by mood on the day.

Additionally, some students struggled with filling in the survey due to reading ages, and English not being their first language. Staff reported some students finding the survey arduous and therefore may have resented filling it in the second time at the end of the trial.

The play period was also in the run up to Christmas, with the second survey being conducted a few days before school broke up for the holidays. Depending on how the students felt about the prospect of the Christmas break, and the fact they were still in school, could have had a large influence on how they felt emotionally at the point at which they filled in the survey.

Future integration into a school setting

Through observing play sessions and interviews with the staff at the schools we learned a lot about the different ways that the game could be used in a school setting and how to make it easier for the staff running the sessions.

Sessions should be longer

The staff at both Queensbridge and Morningside felt the sessions needed to be a little longer than 20 minutes, suggesting 30 - 45 minutes. This would give the children sufficient time for game set-up, play and packing up.

There are multiple ways the game could be rolled out

From discussions with the staff there were three suggested ways to roll out the game:

a) Whole class activity

The advantages of running sessions as a whole class activity is that it can be given a regular slot in the class timetable, and be linked to other curriculum subjects covered by the class e.g. writing reviews of the game as part of an English lesson. It also has the advantage of being a useful activity for when there is “dead time” in the day, e.g. if they have finished an activity early. A whole class activity can also provide the teacher with some time to work with individuals in the class. For example, one of the teachers used the play sessions as a self-directed project with the children taking ownership of handing out the equipment, setting up the game and tidying up at the end. Whilst the class was playing the teacher was able to go over work with those children that needed extra support.

The disadvantages of a whole class activity is that the set-up is more time consuming than with a smaller group. It also means that the staff member is less able



to observe and support the young people in their diaphragmatic breathing technique due to sheer numbers in the class.

b) Small group intervention

The advantages of small sessions are that the staff member can provide a lot of support with set-up, game play and breathing technique. The disadvantage is that the students need to be taken out of lessons which could be disruptive, and the game can't be tied into the main class activities. It may be that this smaller intervention works best with students with behavioural or emotional difficulties who would benefit from more support from the staff member.

c) After-school activity

An after-school club could be run by a member of staff for any students that want to attend, with the school storing the equipment. The advantage of an after-school club is that it doesn't take up curriculum time that is already felt by teachers to be packed full. It does, however, rely on students coming in their own time and fitting with a parent's pick-up schedule.

The game could also be used in after-school clubs as an optional activity, in a selection of lots of different activities on offer. This format has sparked interest among a number of youth groups we have been in contact with, and could provide another possible avenue for roll-out.

Training and engagement of staff is key

All the staff members running the sessions were fundamental to the success of the project. They decided when the sessions were played and ran them, at first with BfB Labs support and then by themselves. In some cases the briefing was slightly rushed, as staff had limited time, and so they missed out on some key elements of the setup and game rules. In future roll-outs we will need to increase our emphasis on the importance of the briefings at the start of the trial, and ensure there is sufficient time to go through the game elements thoroughly.

The real-life benefits of playing the game should be outlined

As discussed earlier in the report, we had purposely not made any comments about the purpose of the game, and the real-world benefits of being able to regulate your emotions as we had wanted to explore what the young people independently took from the game. Staff felt, however, that linking of the game and breathing technique to real-life situations would, in some cases, have made it easier for them to talk about the game. For example, one teacher felt it would have been useful if she could have linked the use of the breathing technique to staying calm and focused during an upcoming test. Based on this feedback we are redesigning the staff training and introductory sessions to ensure they are more explicit about the skills being learned.

There should always be advance IT testing in exact play locations

The game relies on a good wifi connection for smooth gameplay, and also for data capture. While this was discussed with schools well in advance, they were not always aware of the quality and capacity of their own internet access. We have learned that is always necessary to run some tests of the network in advance. This testing should be done in the exact locations the game is to be played as some classrooms and areas in the school have much stronger connections than others, and this can even vary between classrooms that are next to each other. This testing, and any troubleshooting related to it, relies heavily on cooperation and coordination with school IT teams.





Conclusions

When starting the project we had aimed to have 40 young people from Hackney playing our game regularly. We were able to reach 58 regular players, and another 16 young user testers from Hackney. We also trained 6 members of staff in the set-up and play of the game rather than our initial target of two.

Overall this regular play was enjoyed by the young people. Although there was no statistically significant changes in wellbeing scores, the majority of children felt they both learned the technique of diaphragmatic breathing and improved it over the four weeks. Some had even used it outside of the classroom context. There was also particular engagement from some young people who usually had difficulty with behaviour and concentration, leading us to further explore using the game in Pupil Referral Units.

BfB Labs learned a huge amount from the trial. The suggestions and feedback from the young people on the game fed directly into development, particularly comments around the breathing pacer which has undergone a redesign as a result. We will also be redesigning our introductory sessions so that the benefits of the practice, and application to the players' real life are more explicit.

Finally, we were able to explore how the game could be rolled out in a mainstream school context, both with small out-of-class interventions and as a whole class activity, and the different ways teachers and staff may want to integrate it into the school day. This, along with practical tips on how to make the session experience as easy as possible for staff members to run, will be invaluable as we move on to our next stage of development.

Next steps

We used the findings and learnings from this project to feed directly into improving the set-up, IT and game play for a Randomised Control Trial (RCT) that was run with two secondary schools January - March 2016. Results from the RCT will be published in the summer 2016.

We are now looking for opportunities for user testing of the game with other groups of young people, both in schools and other settings such as Pupil Referral Units, youth clubs, or family settings.





For more information about the project, please visit our website: <http://www.bfb-labs.com>

If you would like to discuss the project with us, please contact BfB Labs' Lead Researcher Naomi Stoll at Naomi.stoll@bfb-labs.com

With thanks

A very large thank you to the staff and students at Queensbridge Primary School and Morningside Primary School, whose effort, involvement and feedback have been invaluable to the continued improvement of the game, and our continued learning.