



Development and modelling of a school-based mental health intervention: the co-production of the R.E.A.C.T. programme

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Abstract

The lack of effective school-based interventions for addressing mental health issues and psychological well-being in young people, particularly those with stakeholder involvement, for reducing test anxiety in adolescents has caused a call for interventions to be developed through the process of co-production with the key stakeholders, i.e. teachers and students. The purpose of this paper is to present the development and modelling of a coproduced school-based intervention to improve mental health and psychological well-being in adolescents in the post-primary setting. The intervention was developed through a six step co-production model. This included an extensive evidence review, interviews ($n=7$), focus groups ($n=6$), observations in three school settings and initial modelling of the intervention programme and resources in the co-research partner school. Findings were used to identify the preferred structure and content of the intervention. A six-week intervention for 12–14 year olds was co-produced along with relevant teacher resources and student work books. The intervention consisting of a psycho-educational component and physical activity component underpinned by cognitive, behavioural and self-regulation theories aimed to reduce test anxiety and improve psychological well-being. The co-production model was a successful series of six steps used to create and refine the intervention. The programme represents a theoretically informed intervention comprising multiple components. This study contributes to a better understanding of the determinants of mental health issues among young people and how an intervention can be effectively co-produced. The results suggest that a feasibility study is warranted with teachers delivering the programme.

Keywords Intervention · Development · Adolescent mental health · Usability testing · Co-production

Introduction

Researchers have suggested that stress and anxiety are two of the biggest issues that influence adolescent mental health and well-being worldwide (Gunnell et al., 2016; Parker & Bailey, 2018; Werner-Seidler et al., 2017). Overall an estimated 20 per cent of young people will suffer from anxiety

or depression before they turn 18 years (World Health Organization, 2019; Werner-Seidler et al., 2017). The period of adolescence has been known as heightening mental health issues amongst those aged 10–18 years as these adolescents undergo a series of rapid changes physically, biologically, psychologically and socially which may lead to the development of increased sensitivity to unhealthy behaviours (acting out, smoking, drug use, being withdrawn, losing or gaining weight drastically) due to increased exposure to stressors (Parker & Bailey, 2018; Kumar & Singh Akoijam, 2017; Hagen & Nayar, 2014; McGorry et al., 2013). After the age of 12, stress reactivity becomes more consolidated and problematic to modify due to all the vast changes that occur during this adolescence with increased challenges and academic pressures (Betts & Thompson, 2017; Tottenham & Galván, 2016).

In modern society young people face a number of challenges in the school environment such as academic demands; these challenges have been based on evidence from

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cross-sectional and longitudinal studies and cited within the academic literature as increasing stress and anxiety in adolescents (Gunnell et al., 2016; Shankar & Park, 2016; Hagen & Nayar, 2014). Young people spend a majority of their time in school meaning that they are often subjected to various pressures which can affect their mental health, particularly during post-primary (secondary) education which is filled with periods of adjustments. The World Health Organisation 2013/2014 HBSC survey indicated that among 13–15-year olds from 42 countries in Europe and North America, school-related stress was associated with lower levels of mental health and well-being (World Health Organization, 2016).

The number of standardised examinations have risen with schools beginning to test students from an earlier age, leading to debilitating levels of stress (Putwain & Pescod, 2018; von der Embse et al., 2013; Thomas et al., 2018; Putwain & Daly, 2014; Damer & Melendres, 2011). These increased stress levels experienced by adolescents during examinations can lead to later consequences in stress response in late adolescence and early adulthood as individuals struggle to effectively manage this increased pressure (Damer & Melendres, 2011; Oades et al., 2017). Increased anxiety levels during examinations occur because many individuals feel they have a lack of control over their emotions or the outcome of the examination itself (von der Embse et al., 2013; Putwain, 2008; Casbarro, 2005). Furthermore, the growth of test anxiety stems from the pressure the individuals place on themselves to exceed or pressure from teacher and parents relating to academic achievement (Holt et al., 2018). Therefore, considering the high prevalence of stress and anxiety particularly around examination periods, it is important to identify suitable coping mechanisms. Dealing effectively with these mental health challenges is critical and therefore it is important to development programmes and interventions to help combat this.

Research has recommended early intervention in the school setting for prevention and reduction of mental health issues and try to stem the increasing prevalent before these adolescents transition into adulthood (Colizzi et al., 2020; Fazel et al., 2014;). However, designing an intervention can be a complex process; as Fraser and Galinsky (2010) illustrated, especially one targeted at young people in the school environment as there is limited data available regarding the development process (Lloyd et al., 2011). Research suggests that the success of school-based interventions has been sporadic (Evans et al., 2015; Fazel et al., 2014;), perhaps due to the lack of collaboration and input from key stakeholders. Some available evidence does, in fact, support this; when designing an intervention for young people, a crucial component is engaging key stakeholders in the development of the programme as this should help ensure

effective implementation (Daly-Smith et al., 2020; Majid et al., 2018; World Health Organization, 2012). Therefore, the study presented in this paper seeks to build on this evidence and develop an intervention that is specifically designed in conjunction with schools.

Stakeholder involvement has become an increasingly essential element in the development of complex interventions. Researchers have acknowledged that co-production has the potential to be more meaningful in the research and development process through an interdisciplinary or trans-disciplinary approach (Clarke et al., 2017;). Evidence has consistently shown that co-production is a logical approach in the development of effective complex interventions particularly those related to mental and public health (NIHR, 2018; Clarke et al., 2017; Filipe et al., 2017; Hawkins et al., 2017). The rationale behind this stems from evidence which suggests that the process of designing and developing an intervention is bound by knowledge development (Fraser & Galinsky, 2010). Allowing participants and key stakeholders the opportunity to have their voice heard will provide the knowledge needed for intervention development and enhance the quality of research findings (Filipe et al., 2017; Hawkins et al., 2017).

With the call for the inclusion of stakeholders in developing services and interventions, a number of studies have included frameworks of co-production to improve programme design, feasibility and effectiveness. A key component of these frameworks is stakeholder involvement from the beginning of the project through to the development and evaluation stages (Hawkins et al., 2017; McConnell et al., 2018; Morrow et al., 2010). The involvement of stakeholders will allow for the development of innovative solutions as it places less constraints on the thinking process (NIHR, 2018). However, to date, these frameworks have mainly been used in the public health setting and therefore are not directly applicable to schools. This paper describes the six step co-production process used within the school setting which drew on previous research indicating the importance of involving stakeholders in designing, planning, delivering and assessing interventions (Hawkins et al., 2017; McConnell et al., 2018; Morrow et al., 2010; White et al., 2017). The aim of the study reported in this paper is to describe the initial development of the R.E.A.C.T. (Reducing Exam Anxiety through Activity and Coping Techniques) intervention that has been co-produced with one school to improve mental health and psychological well-being in adolescents through a series of objectives. Firstly to outline the six-step approach to co-produce a school-based intervention to improve mental health and psychological well-being. Secondly to examine the usability of the intervention in the school setting and finally refine the initial intervention based on key stakeholder feedback.

Methods

Study Design

The study adopted an exploratory qualitative research design, a s flexible path of inquiry which provided essential information to help establish an in-depth understanding of the research problem and programme development. The methods adopted allowed for an integration of the available evidence with stakeholder knowledge for intervention co-production. As there is little consensus of how co-production is best utilised (Clarke et al., 2017), co-production in this research drew on previous evidence which highlighted the importance of involving stakeholders in planning, delivering and assessing interventions (Hawkins et al., 2017; McConnell et al., 2018; Morrow et al., 2010; White et al., 2017). Co-production was used to develop the intervention in this research through a six-step approach; (1) evidence review, (2) problem identification, (3) co-production of intervention prototype, (4) co-delivery and joint analysis with partner school, (5) modification of intervention and (6) programme feasibility and refinement (Fig. 1). The initial intervention was developed and tested over three phases: Phase 1: Evidence and identification; Phase 2: Intervention Development – Planning stage; and finally, Phase 3: Testing. The key stakeholders in the development process were Queens University Belfast, Royal Belfast Academical Institution (RBAI), post primary school students and post primary school teachers. RBAI was designated as the

partner school to co-produce the intervention with researchers from Queen’s University Belfast.

Research Setting

The study was conducted in a school-based setting in several second level grammar and secondary schools in Belfast, Northern Ireland.

Recruitment of the Participants

Recruitment for this study was voluntary across schools in Belfast. There were three levels of recruitment for the research purpose.

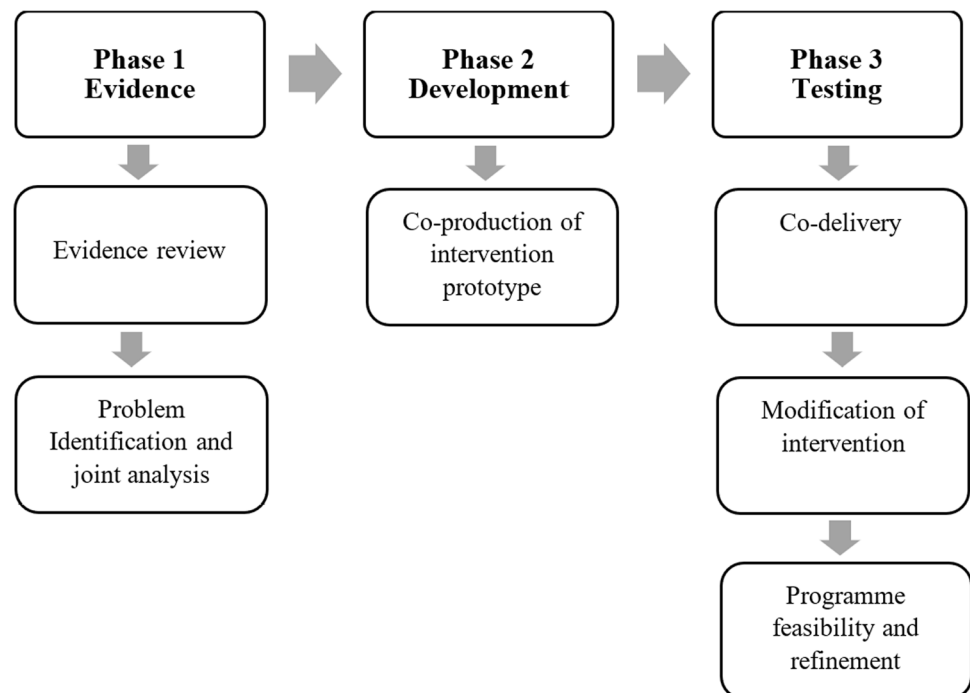
Recruitment of School for Co-Production Process

One school, RBAI was recruited as a partner to help co-produce the intervention. Teachers and students from this all-boys grammar school remained actively involved from project conception to completion. The rationale behind the recruitment of a co-research partner school stemmed from evidence indicating that co-production allows the research programme to follow an evolutionary pathway, clear framework and provides opportunities for learning.

Recruitment for Interviews and Focus Groups

Teachers and students from the co-research school took part in focus groups and interviews. Six focus groups were

Fig. 1 Research co-production process



conducted with 32 male students aged 12–18 years. Students were purposively sampled from a range of age groups to allow for a variation in knowledge and experience of mental health. A semi-structured focus group guide was used consisting of broad, predominately open-ended questions relating to mental health issues in young people and possible intervention components. Semi-structured interviews were conducted with seven teachers from the co-research school. Teachers were selected to allow for variation in teaching background and existing experience of mental health in schools.

Recruitment of Schools for Observations

The co-production school was recruited for observations to be conducted across the whole school setting. Two additional schools were invited to take part in research observation only and were chosen due to their differences with the co-research school (i.e. an all-girls grammar school and a co-educational integrated secondary school). Observations were conducted by one researcher (first author) in all three schools.

Recruitment for Initial Testing of the Intervention

Participants from the co-research school were recruited to take part in an initial usability test of the intervention. One class of year 9 students (ages 12–14 years) were recruited to participate in the initial testing phase.

Ethical Considerations

All schools and participants involved in this research were informed of the purpose of the research and completed consent forms before participation in the study. Participants under 18 were also provided with a parental opt out form, which was sent home with the students and returned if the parents did not wish for their child to take part in the research. No data was collected until all appropriate forms had been signed and returned. Ethical approval was gained from the School of Social Sciences, Education and Social Work at Queens University Belfast (12th March 2018 and 7th November 2019; Ref no: 005_1920).

Data Collection

The fieldwork for the research reported in this paper was conducted through the six-step co-production approach (Fig. 1), which took place between August 2017–January 2020. This paper details the work with the co-production partner school collected from March 2018–May 2019. The research process took 20 months to complete from first discussions on the research process to the initial creation of a full intervention prototype.

Phase 1: Evidence and Identification

This was the pre-development stage of the intervention and was carried out in two steps, (1) an evidence review and (2) problem identification and joint analysis.

Step One: Evidence Review

Step one involved gaining an understanding of adolescent mental health by reviewing the existing literature. Ongoing discussions were held with the co-research partner school to identify areas of literature to examine and helped identify that stress and anxiety around examination periods was an area to consider for the intervention. This intensive reading and review period allowed the project team an opportunity to gain a clearer picture on the issues that young people may face and highlighted the seriousness of mental health and well-being issues amongst this population.

Step Two: Problem Identification and Joint Analysis

Unstructured consultations between the researcher and co-research team were conducted throughout the development phase of the intervention to identify the key problem for the intervention focus and a specific target population for the programme. This co-research team included the principal, school well-being co-ordinator and senior teachers ($n = 10$). Additionally, semi-structured interviews ($n = 7$), focus groups ($n = 3$) and observations across the whole school setting were also conducted as part of the co-production framework. Finally, during step two, the co-research partners and researcher conducted a joint analysis of the qualitative data from the focus groups and interviews. The schools included within the research were all of different socioeconomic status (neighbourhood, affluence, religion, educational attainment status), this provided a sample that was representative of the three main secondary school types within the Northern Ireland education system.

Phase 2: Development

Step Three: Co-Production of Intervention Prototype

Once data had been analysed from step two, a range of unstructured consultations took place in the co-research school. The stakeholders in this school had extensive experience of the issues young people face, experience of intervention delivery, programme development (particularly in the education setting) and the potential facilitators and barriers to intervention implementation in a school setting.

R.E.A.C.T. Intervention

The R.E.A.C.T. programme was developed through the process of co-production, based on qualitative research conducted within the school setting and through an extensive literature search. The programme is a 6-week 30 min school-based intervention for adolescents aged 12–14 years old which aims to (i) improve knowledge about anxiety and test anxiety, (ii) promote the use of different coping techniques, (iii) facilitate peer learning, and (iv) promote self-belief. The main focus of the intervention is to reduce anxiety, particularly around exam time and increase coping mechanisms. A core element of the intervention is its group-based format which incorporates psycho-education with physical activity exercises. This intervention is novel in its integration of physical activity as a stressor-reduction and the use of psycho-education to enhance mental health literacy and help reduce anxiety by teaching coping strategies. A description of the programme sessions is outlined in Table 1. The control group did not receive the R.E.A.C.T. intervention but continued as normal with their school day.

Phase 3: Testing

Following on from Phase 2, the development process of the intervention continued with the testing of the programme. Interventions require a testing stage to ensure they are tailored appropriately to their target population and identify any weaknesses within the design (Fraser and Galinsky 2010). Phase 3 involved three steps, co-delivery, modification of the intervention and programme feasibility. Based on suggestions from Fraser and Galinsky (2010) qualitative research was conducted through a single group design (i.e. only one group – an intervention group – was used in this phase). This design helped provide detailed information to assess the intervention procedures (i.e. data collection and programme content), identify any significant challenges and identify content to be optimised in the next phases of the research (Fraser et al., 2008; Kao et al., 2018). The outcomes

were assessed over different time points (baseline, post-intervention and follow-up). Data were collected between October and December 2018.

Step Four: Co-Delivery

The intervention prototype was modelled to examine the processes and outcomes of the programme. The researcher (first author) and a member of the co-research team JA were responsible for the facilitation and delivery of the intervention.

Step Five: Modification of Intervention

Step five in the co-production process was conducted post-testing of the programme. Student feedback and session observations were collated to gain information on the suitability of the programme. This step involved reviewing the feedback and making necessary changes for future testing of the intervention. RN and JA refined the programme over two meetings based on the feedback from the participants, noting what worked and what changes were required. The results of this phase were evaluated and discussed by the academic research team and the co-researchers. Key refinements to the programme were made to improve implementation and inform future delivery and research outcomes.

Step six: Programme Feasibility

The last step in the co-production process was to finalise the intervention content and resources by carrying out feasibility studies. This was an important step to assess the recruitment and retention of participants, outcome measures, data collection procedures and the acceptability of the intervention to the target population and the designated setting, i.e. the school (Orsmond & Cohn, 2015). The results of the feasibility studies are discussed elsewhere (in preparation).

Table 1 Features of the R.E.A.C.T. programme

Features	
<i>Structure of Intervention</i>	6 sessions, each session lasting approximately 25 min
<i>Structure of session</i>	Welcoming students to session. Introduction to session topic and recap of previous topic. Group discussions and worksheets. Fun activity relevant to the topic area. Session recap and task worksheets
<i>Areas covered</i>	Sessions 1–2: What is anxiety and how do we react? Sessions 3–6: Coping Strategies
<i>Tools</i>	Teaching resource with step-by-step instructions for delivering each session Student resource with information sheets and activity worksheets
<i>Additional features</i>	Use of group setting for social support Use of appropriate physical activity exercises Programme was based on the principles of behavioural, cognitive and self-regulation theoretical components

Data Analysis

Audio recordings of the interviews and focus groups were transcribed verbatim and analysed on qualitative software NVivo, using a six-step thematic analysis process (Braun & Clarke, 2006) and participation theme elicitation (PTE – Best et al. 2017, 2019). Field notes from stakeholder consultations and observations were collated and combined with the themes that emerged from thematic analysis. The full data set was reviewed and coded to identify the key mental health perspectives of the participants and identify key intervention components. The findings from these analyses are discussed in detail in previous research papers (Neill et al. 2021).

Results

The findings from the study are presented in the order in which the phases were conducted and reflect the six-step co-production process.

Phase 1: Evidence

In phase 1, a systematic review on the effects of physical activity interventions on mental health outcomes in young people found evidence supporting a multi-component intervention to improve these outcomes (Neill et al. 2020). Included studies from (Melnyk et al. 2009, 2013, 2015) supported the use of a school-based intervention to improve depressive and anxiety symptoms amongst the adolescent population. The COPE intervention (Melnyk et al., 2009, 2013, 2015) was one of the only interventions within the review that consisted of multiple components and a theoretical basis; this programme has been able to be replicated and delivered to multiple schools. This finding helped identify that a multi-component intervention for this project would help ensure it is feasible and sustainable in the long term. The review identified that poor mental health outcomes can be reduced through interventions that incorporated physical activity as a component. Each intervention reviewed had different variables (intervention design and activity types) which provided direction for the duration of the intervention and programme content to be designed. An additional review of the literature indicated that anxiety issues are often under-examined in the adolescent population (Biddle et al., 2020; Fergus and Limbers 2019).

The qualitative findings from the field work, interviews, focus groups, observations (under review) and joint PTE analysis (Neill et al. 2021) combined with the academic literature were incorporated into recommendations for an intervention strategy then discussed with key stakeholders. These findings shaped the co-produced intervention

in several ways; firstly, identifying the main outcome to be investigated; test anxiety and psychological well-being. Evidence suggested that adolescents are now facing more pressure within education to perform well in examinations (Yüksel et al., 2018; Shankar & Park, 2016). As a result of this researchers have acknowledged that this anxiety can create a pattern of negative thinking and behaviours which reduces psychological well-being (von Der Embse et al., 2013; Putwain, 2008). These findings indicated that test anxiety should be examined within the context of an intervention and therefore formed the basis for the R.E.A.C.T. intervention content. Educational and physical activities were highlighted important components be incorporated into the programme design with links to negative thinking traps and how this thought process can be turned into a more positive mind-set and help develop coping.

The inclusion of the student and teacher perspectives within the programme design can help increase the intervention feasibility and acceptability in the school setting. Participants provided examples of mental health issues and suggested that education, communication and physical activity could be used to reduce these difficulties, which will be incorporated into an educational component within the intervention developed in this project. Thirdly, there was a strong consensus among the teachers and students that physical activity would be an important component to include due to its link with change in behaviour and reduction in stress. The findings from steps 1 and 2 of the co-production process illustrated that an intervention should be designed to help reduce test anxiety through educational discussions and fun physical activities.

Phase 2: Development

Based on previous findings and discussions in Phase 1, the R.E.A.C.T. programme was created with the aim of reducing test anxiety and improving psychological well-being amongst adolescents. The co-production approach adopted for the development of the intervention should help facilitate the desired changes in outcomes examined. As part of the co-production process, the initial programme consisting of 12 sessions was discussed with the co-researchers. The co-researchers suggested that the initial plan of 12 sessions once weekly may not be feasible on a long-term basis for schools in NI to facilitate, as curriculum time is already stretched. As a consequence, the programme was re-designed to run from 12 weeks to six weeks. The perspectives of these co-researchers was vital for ensuring the intervention could be tailored to be acceptable for the school setting. The final intervention prototype for testing in Phase 3 of the study consisted of a six-week programme comprising 25–30 min sessions once weekly at a time convenient to the school.

The programme aims to (i) improve knowledge about anxiety and test anxiety, (ii) promote the use of different coping techniques, (iii) facilitate peer learning, and (iv) promote self-belief. A core element of the intervention is the group-based format which incorporates psychoeducation with physical activity exercises. This intervention is novel in its integration of physical activity to reduce stress and its use of psychoeducation to enhance mental health literacy and help reduce anxiety by teaching coping strategies. The mental health content was developed by the researcher based on past delivery of school-based interventions and examination of mental health literature and support networks. This content was discussed with the co-researchers who provided knowledge on mental health and the school setting. The key features of the intervention programme are outlined in Table 1.

Phase 3: Testing

Sample Characteristics

A total of 16 adolescent male students in Year 9 aged between 11–13 years old (mean age = 12.25, SD = 0.45) in the co-research partner school were invited to take part in modelling the intervention process and outcomes. All 16 participants remained in the study with no withdrawals, which suggested a level of acceptability for the R.E.A.C.T. programme. This therefore indicates a class group could easily be selected for feasibility testing in future phases of the research. The programme was extremely well attended over the six sessions, with 97 per cent attendance. The other three per cent were attributed to absences due to illness and other extra-curricular activities. As attendance was high, this could indicate that participants enjoyed the sessions and suggests a high level of acceptability for the R.E.A.C.T. programme at least among this particular sample.

Programme Acceptability and Usability

Findings indicated that most participants enjoyed the programme with 94 per cent enjoying it ‘most of the time’ ($n = 15$). The participants’ enjoyment of the programme was also highlighted in the programme feedback survey; several noted that they were happy and excited when they were participating in the programme. One student said that they ‘... felt happy as I was part of a team’ highlighting the importance of the social interaction component of the intervention. Observational data indicated that the participants enjoyed, and were highly engaged in, all aspects of the programme. The member of the co-research team (JA) who assisted with programme delivery reported that student engagement during a number of the session activities was high, noting ‘the students really responded to the activities that

included basketball, the activity was a more inclusive game and appeared to allow them to relax’. This suggests that more inclusive activities should be considered in the future testing of the programme. Activities such as basketball are not a predominant sport in a number of schools in NI and therefore students are placed on a more level-playing field in relation to their skills and knowledge, making it more enjoyable and acceptable. The observations and teacher feedback indicate that these games increase interaction and fun for the participants. Therefore, programme enjoyment appeared to develop from the different educational and physical activity components within the intervention sessions thus suggesting that the programme was highly acceptable during this testing stage. Overall, the findings regarding participant enjoyment demonstrate the usability of the intervention content in the target population and school setting.

During this development stage, it was important to ascertain whether the multi-component element of the programme was valid. Participant feedback suggested that the programme was very well received, with no participants stating that the programme was poor or needed improvement. Results from the programme evaluation feedback demonstrated that all participants rated the overall programme quality as excellent ($n = 6$) or good ($n = 9$). However, this, to some extent at least, contradicts the individual session content rating as five participants thought that several sessions were only satisfactory. One drawback was that participants did not give any reason why they rated the sessions as satisfactory. This indicates that while the overall programme has been well received by the Year 9 students, the content of the sessions will need reviewed and refined before the next phase of the intervention testing.

When asked about the session content, most of the participants found the content good ($n = 6$) or excellent ($n = 4$). This highlights a good level of usability with the programme content. By acknowledging and implementing this feedback from the participants and including more activities and discussions this rating should improve. Observational data suggested that participants engaged in each session and that within sessions, the group format allowed the session content to be understood and explored. Therefore, group interaction must remain a part of the programme and session content to stimulate conversation and learning. Participants said that they found the programme interesting and enjoyed ‘learning about how to prevent anxiety and stress’ and ‘learning about what feelings can do.’ This suggests that the different programme components were useful for helping them reduce anxiety as they had gained more knowledge on how to cope from the programme sessions. The combination of educational component and physical activity games were well received from the participants with a majority indicating that they found both components useful.

This indicates that participants felt that the multi-component structure of the sessions was valid and acceptable demonstrating suitability for conducting a feasibility test of the intervention in the next part of the research phase. Observational data also provided evidence that the programme structure increased engagement levels when participants knew that an activity was following the educational content. The data suggested that the overall delivery length and session time for the intervention was acceptable for the programme to be implemented in the normal school day for several reasons. Firstly, the programme was able to operate alongside the school's current personal development programme, offering education on areas not covered during that curriculum time. Secondly, the intervention allowed for a balance of education and activity that engaged students for the full session time, which may not be possible if the sessions were longer. Thirdly, the intervention fitted into the school day without affecting curriculum subjects and extra-curricular activities.

Participant feedback indicated that they found the programme beneficial with participants acknowledging that they had increased their 'knowledge on exam stress' and on how to overcome anxiety during examination times and in their daily lives. One participant stated they learnt 'how to control your nerves' which was important to them around examination periods. Another stated that they 'have been able to cope better with problems' suggesting that they gained new coping strategies. An important finding from the programme is that it got the young male participants engaged and talking about mental health. Participants were eager to learn more about mental health with one student noting that it would be important to '...include more about other mental health issues and what we can do for it'. These findings demonstrate that the intervention components may be a less stigmatising approach to preventing/reducing mental health related issues within this population that a single component intervention.

Programme Refinements

During this phase, step five, refinement was continuous to ensure the intervention was adapted for the group and for possible future testing. This review process combined expert and key stakeholders' (students and teachers) thoughts on the intervention. The school's wellbeing coordinator and member of the co-research team (JA) assisted the researcher on initially reviewing the sessions. This was a cornerstone in the co-production process as the key stakeholders were involved in the evaluation of the programme (Clarke et al., 2017); Furthermore, drawing on rich data from observations during the intervention, future sessions will be amended to help participants develop a clearer understanding of the key concepts. Positive feedback was received from students and co-researchers indicating that no major changes should

be made to the overall programme content. Findings from observational data and feedback from the co-researchers suggested that the themes of the sessions worked well. However, the content and activities could be amended for example by shortening elements of a session to allow more time for other activities. Overall, components of the intervention were well received within the intervention school, suggesting only a slight refinement of the programme was necessary. This was reflected by the well-being coordinator who noted 'the dodgeball activity was good for teaching approach to life. It was a great activity to encourage students to face things in life head on, take hits, great metaphor for life.'

Based on feedback from the participants and the co-researchers, several modifications were suggested for the future implementation of the R.E.A.C.T. time in schools. The first suggested change was the use of the session worksheets. Feedback indicated that some of these worksheets could be made a group task which might help create a more socially inclusive environment which can improve the learning process. Alternatively, the student workbook could be turned into an online resource for a point of reference; this would be more cost-effective for schools in the long-term. Secondly, some participants noted that they would prefer the activities in the sessions to be linked more closely to the session outcomes. One student suggested 'making 'more activities and base the activity on what we are learning'. This indicates that the session structure needs examined and that a clearer link must be established between the educational component and the physical activity games. Furthermore, the recap at the end of the session must also provide an opportunity to link these elements together. Overall refinements are outlined in Table 2.

Discussion

This paper describes the development of a co-produced school-based mental health intervention and presents the results of an initial usability test that modelled the intervention with one group of students. The six step co-production process highlighted the importance of engaging key stakeholders in the development of school-based interventions and how this input is valuable in helping modify intervention components for the target population and setting.

The findings from step one and step two were combined to determine the most suitable components for the intervention and identify the appropriate outcome measures. These steps were vital as they identified a specific target group and one main outcome for the intervention focus. Furthermore, step two was beneficial in uncovering the facilitators and barriers for intervention development (*Paper under review*). Understanding the intervention's fit within the school environment

Table 2 Refinement of the intervention for future feasibility testing

Version 2	Changes for Version 3	Notes
Session 1: Why are you anxious?	Educational component altered Activity remained the same	On the basis of participant feedback, worksheets were removed and flipchart paper used to facilitate more group interaction
Session 2: How does your body react during exams?	Revision to activity	Activity was altered to make it more structured and to increase the pressure on participants to replicate exam anxiety
Session 3: Coping Strategies	Activity changed	The minefield activity was changed to Gold Rush to create more a pressure situation, so participants could make the link with stressors and coping
Session 4: Behavioural Regulation	Activity changed	Smaller size and easier word search as previously word search proved to be difficult to complete in the timeframe. The activity was changed from Endball to 'Connect Four' to make the physical activity component more fun and interactive
Session 5: Negative thinking traps	Activity component was moved earlier in session	(JA) felt that the session would flow better if the content was flipped around i.e. flip the education session and activity components around to improve the link and understanding between the key concepts of the lesson. Change the educational component to a group-based activity and remove the short quiz
Session 6: What do you do on the day of an exam?	Activity changed	The shuttle run activity was changed to basketball as this activity was recommended as a more inclusive physical activity than running and incorporated more social interaction

and reflecting on the process of developing the intervention helped ensure that the best outcomes and components were chosen for the R.E.A.C.T. programme (Wight et al., 2016). There was a consensus amongst students and teachers that test anxiety was a main source of stress and anxiety which could be detrimental to adolescent well-being. The main ways discussed to help reduce and prevent test anxiety from becoming more serious and to improve well-being were an intervention centred around communication, education and physical activity. Additionally, students and teachers noted that the intervention should be delivered over a short period of time and ideally fit into the school environment.

These insights from key stakeholders helped create the R.E.A.C.T. intervention. The programme included fun educational activities once weekly for 30 min over six weeks. By incorporating the programme into the school day, we were able to prioritise successful programme implementation and ensured that the programme was suitable for delivery without taking away from a curriculum subject or being delivered after school. In designing the intervention, participant engagement and enjoyment was evidenced as a vital component to ensure programme sustainability and interest (Herlitz et al., 2020). The high attendance rate and high programme rating provided the evidence of participant engagement, acceptability and programme usability for the target population and implementation in the school setting. Based on these findings, a feasibility test of the R.E.A.C.T. programme with a larger sample is warranted to further refine

the intervention necessary before a full pilot randomised control trial can be conducted before resources can be freely available to schools.

Limitations

Firstly, only one school was used as a partner for co-producing the mental health and well-being intervention. It is an all-male grammar school which means that there is little diversity in the student population. This limitation means that there are restrictions on the generalisability of the findings to other schools. This may have led to important information about the school setting or possible intervention components to be overlooked (Ip et al., 2013). To help overcome this limitation, two other schools were included during the observations. They were different to the co-researcher school (an all-female school and an integrated co-educational school). The involvement of two additional schools allowed for further perceptions of adolescent mental health and factors related to intervention development to be identified and explored. To strengthen intervention refinement for future implementation, it would be beneficial to include key stakeholders from other schools within the co-production, development and refinement processes, to ensure a more efficient and sustainable intervention.

Secondly, the length of time and required commitment for co-production to occur can be a limiting factor to the

research process. During the process, the school timetable and busy schedule of teachers placed time constraints on the project to be completed within an accelerated time-frame. However, the establishment of clear two-way communication, a good support network and mutual understanding of the benefits of the research helped overcome the time constraints and ensured that time was set aside for all opinions to be voiced. Also some scheduling issues and then the COVID pandemic meant we were unable to get further interviews and focus groups with the co-research team and students at the end of these steps. This limits the research as further reflection may have enhanced programme refinement for future delivery. Thirdly, whilst an inductive coding approach was applied during the thematic analysis of the qualitative data, it is acknowledged that it is unrealistic to completely remove the researcher's prior knowledge and epistemological position in identifying and redefining codes (Braun & Clarke, 2006). To address this issue, reflectivity was conducted throughout the research process as well as involving co-researchers through the PTE analysis process to try to reduce the possibility of researcher bias.

Overall, the co-production process was a strength of the study, the flexible and iterative process used key stakeholders with knowledge and experience that was vital for the development of the intervention. This input will also assist in future programme buy-in from other schools. Additionally, the process helped ensure that the initial programme was acceptable to both students and schools which is a major strength of using a co-production approach within the development of complex interventions.

Conclusion

The results presented in this article highlight that while developing mental health interventions is complex, co-production is a crucial part of the research process. We recognised the importance of co-producing an intervention with the input from key school stakeholders, i.e. teachers and students. The model presented here and initial testing of the intervention prototype provides a step by step approach to co-produce complex mental health interventions. The involvement of these key school stakeholders was important in determining the design of the R.E.A.C.T. intervention and refinement of the programme as well as initial testing. The findings demonstrated the intervention is usable in this target population and setting with a high level of acceptability in programme content and delivery. However, findings suggested the need for some refinements to ensure the programme is feasible and sustainable in the long-term. Future studies should investigate the testing of the intervention in multiple schools and evaluate the feasibility and preliminary effectiveness of the programme for adolescents while further

using the process of co-production to refine the programme for sustainable and successful future implementation.

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Data Availability The data collected and analysed during this study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval The study was granted ethical approval by Queen's University Belfast, School of Social Sciences, Education and Social Work Ethics Committee. Participants provided written informed consent to participant in the study.

Consent for Participation All participants and schools included provided consent to participate.

Consent for Publication Not applicable.

Competing Interests All authors declare that they have no competing interests.

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