

Resilience in the curriculum: outcomes of a curriculum infusion intervention with neuroscience students

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Abstract

Student mental health is of critical concern in higher education, with increasing numbers of students needing support. It is crucial for higher education providers to develop preventive strategies that will ensure students' mental health and academic success not only are maintained, but improved, through university and beyond. This paper reports on a UK study that aimed to embed mental wellbeing and resilience skills within the neuroscience curriculum using a 'curriculum infusion' approach. A programme was designed that included a series of 'neurobiology of resilience' workshops and reflective activities within compulsory modules. Students were surveyed at the end of the semester using the Resilience Scale for Young Adults, as well as questions on lifestyle and growth mindset. Additionally, thematic analysis was carried out on extenuating circumstances (EC) claims placed to identify changes in the number of mental health-related concerns. It is perceived that this approach might be of particular benefit for 'non-traditional' or 'widening participation' students, and students from minorities or disadvantaged groups, as part of strengthening their internal locus of control.

The study compared results from a cohort receiving the intervention (N=42) with results from a previous cohort who did not (N=28). It found that students receiving the workshops showed significantly higher mental resilience in terms of optimism, adaptability and a decrease in emotional reactivity. This was accompanied by a lower proportion of mental health-related ECs submitted.

Key words mental health, mental wellbeing, students, resilience, STEM

Introduction

Recent data shows that the mental health of students in higher education is of critical concern (Office for Students, 2019). Students considered 'non-traditional' or 'widening participation' (WP, in particular ethnic minority students) are more likely to suffer from poor mental health but are less inclined to seek help (Turner *et al.*, 2007; Soorkia, Snelgar and Swami, 2011; Sancho

and Larkin, 2020). The number of first-year students reporting a mental health problem in 2016 was three times higher than in 2006 (Thorley, 2017), and difficulties with mental wellbeing are associated with student attrition and non-continuation (Office for Students, 2019; Andrews, Clark and Phull, 2020). As a result, there has been an increase in demand of counselling and mental health services in higher education, putting huge pressure on the universities' welfare resources. Universities and sector bodies are increasingly aware of the need for positive action to support student wellbeing, and this has resulted in a number of calls to action to improve staff and student wellbeing (Hughes and Spanner, 2019; Universities UK, 2020)

The World Health Organisation advocates for a 'prevent and promote' approach to mental health (Davies, 2013). This means that while it is important to ensure that students struggling with their mental health are supported with their recovery, it is equally crucial to develop preventive strategies to ensure that students not only 'survive' but also thrive through university and beyond (crucial skills particularly in the uncertain times we are facing). In order to address this, academics are increasingly taking a proactive approach aiming to include mental wellbeing within the curriculum (Gilbert, 2016; Holdsworth, Turner and Scott-Young, 2018; Lister and McFarlane, 2021; Lister, Seale and Douce, 2021; Lister, In press).

This paper reports on a study that took place in a Russell Group university in the UK as part of a collaborative project with sector body Advance HE. It aimed to embed mental wellbeing and resilience skills within the curriculum using a 'curriculum infusion' (Houghton and Anderson, 2017; Valtin, McWilliams and Ebenbach, 2018) approach. A series of 'neurobiology of resilience' workshops were designed and embedded as part of the compulsory neuroscience modules. These workshops presented peer-reviewed evidence (e.g. meta-analysis) showing the positive impact of resilience interventions on mental health, and students took part in discussions of some of the mechanisms underlying their positive effect. These were supported by lectures that included practical strategies for resilience, drawing on a growth mindset approach (Dweck, 2017).

Students' levels of resilience were assessed using the Resilience Scale for Young Adults (RSYA) (Prince-Embury, Saklofske and Nordstokke, 2017), along with questions on lifestyle and development of growth mindset (Limeri *et al.*, 2020). Additionally, a thematic analysis (Braun and Clarke, 2006) was performed on the extenuating circumstance claims placed by that cohort in order to identify changes in the number of mental health-related concerns. This paper reports and discusses the outcomes of the testing and thematic analysis to draw conclusions about any impact of the curriculum infusion intervention on students' levels of resilience and wellbeing. First, however, this paper critically examines the literature around resilience, student wellbeing and curriculum infusion.

Wellbeing and resilience

Resilience is a term commonly used in student mental health literature (Houston *et al.*, 2017; Holdsworth, Turner and Scott-Young, 2018; McAllister *et al.*, 2018); however, defining resilience is a complex task (McCubbin, 2001). In 2016, Aburn *et al.* carried out a systematic review to examine how resilience is defined in empirical research, and found no universal definition (Aburn, Gott and Hoare, 2016).

Personal resilience is often described as the ability to 'bounce back' after a crisis, and this definition in particular is strongly linked with mental health (Davydov *et al.*, 2010; Holdsworth, Turner and Scott-Young, 2018). Some studies suggest resilience is inherent within individuals (Werner, 2005), while others posit that resilience develops over time (Masten and Tellegen, 2012), and is made of 'ordinary rather than extraordinary processes' (Masten, 2001).

At its core, resilience is a set of skills, values, strengths, support systems, strategies, experiences, behaviours and capabilities people draw on that allows them to cope with periods of chaos or crisis and move on without long-term negative consequences; these are termed 'protective factors' and it is recognised that they can vary immensely for different people and in different circumstances (Bellin and Kovacs, 2006). Two types of protective factors are commonly recognised in the literature: internal and external. Internal protective factors tend to be personality traits, qualities or characteristics, such as optimism,

self-efficacy and coping strategies (Rutter, 2006; Johnson, 2008). Some studies suggest these are inherent within individuals (Werner, 2005), while others posit that they develop over time (Masten and Tellegen, 2012). In contrast to this, external protective factors are based on the environment, and include support structures in the home, peer or family group and community (Masten, 2000).

According to Prince-Embury et al., resilience can be broken down into (and measured by) three core dimensions: Sense of Mastery, Sense of Relatedness, and Emotional Reactivity (Prince-Embury, Saklofske and Nordstokke, 2017). This study adopts this definition and model of resilience, and uses the scale Prince-Embury et al. proposed to measure resilience. The three dimensions are therefore described in more detail in the next paragraphs.

Sense of Mastery includes an individual's confidence in what they are doing, and a sense that they are able to master the skills required of them and adapt to challenging circumstances. It also includes a strong sense of identity and positive self-perception (Prince-Embury, Saklofske and Nordstokke, 2017). The concept of a sense of mastery builds on literature around self-determination (Deci and Vansteenkiste, 2004), self-efficacy (Bandura, 1997) and self-regulation (Garrin, 2014), whereby individuals can master, or be supported to develop, skills around competency, intrinsic motivation and coping skills (Garrin, 2014). It also draws on theories of identity, which relate to how a person perceives and defines themselves, both in general and in the context of the groups to which they belong, and is seen as critical to mental wellbeing. Research shows that if a person has a 'deficit identity', i.e. believes they are a 'risk' (Scott and Wilson, 2011) a 'burden' (Sabat, Napolitano and Fath, 2004), or has a 'lack of motivation... hopefulness and self-esteem' (Scott and Wilson, 2011); this can have a negative effect on their mental health. However, having a 'valued social identity', in which people have 'hope' and 'confidence' and believe they are 'valued, contributing and unique' (Scott and Wilson, 2011), has been shown to have a positive impact on self-esteem and mental wellbeing (Branscombe and Wann, 1994; Sabat, Napolitano and Fath, 2004). This is interesting when juxtaposed with a 'paternalistic and condescending mainstream health system' (Scott and Wilson,

2011), which positions mental ill health as a deficit and a burden, and may contribute to exacerbating the mental health issue.

Sense of Relatedness includes the trust an individual has in the people around them, and the ease or comfort they feel with these people. It also includes their perceptions of access to support in times of need (Prince-Embury, Saklofske and Nordstokke, 2017). It builds on the literature around an individual's sense of belonging. Maslow believed the need to belong to be fundamental to human nature (Maslow, 1943), and studies have found it to be essential to mental wellbeing (Hagerty *et al.*, 1992; Kawachi and Berkman, 2001). Belonging is a complex and multi-layered phenomenon; it is perfectly possible for people to feel a sense of belonging with a group of friends, a class or a school, yet feel that they don't belong in other 'collectives', such as their community or wider society (Yuval-Davis, 2011), or to feel a deep-rooted vocation for a subject and yet struggle to 'negotiate a sense of belongingness both in student and professional communities' (Cardwell and Lewis, 2017). For WP students, their sense of relatedness within the university might be lower. For example, ethnic minority students in predominantly white colleges have reported higher levels of isolation than their peers (Guiffrida and Douthit, 2010).

Emotional Reactivity relates to how 'arousable' an individual may be when faced with challenges, in terms of the 'speed and intensity of an individual's negative emotional response' (Prince-Embury, Saklofske and Nordstokke, 2017) and the extent to which the response affects or upsets the individual. This builds on theories of temperament (Rothbart and Derryberry, 1981) and of models of resilience relating to self-protection, harm-reduction and recovery and growth following adverse experiences; the ability to 'bounce back' (Davydov *et al.*, 2010).

In a university context, students' levels of resilience have been associated with their academic outcomes (Holdsworth, Turner and Scott-Young, 2018; Zembylas, 2020). It is commonly recognised in the literature that university culture and systems can be challenging for students (Tinklin, Riddell and Wilson, 2005; Coughlan and Lister, 2018; Lister, Coughlan and Owen, 2020b, 2020a; Lister *et al.*, 2020; Lister, Seale and Douce, 2021). Studies have taken the approach of trying to increase student

resilience and build coping mechanisms to ensure greater academic success (Holdsworth, Turner and Scott-Young, 2018), but concerns have been expressed at the extent to which universities may be characterising resilience as 'individual responsibility for success and failure' (Zembylas, 2020). In doing so, this creates a narrative of students being celebrated for their individual strength and personal resilience in overcoming obstacles, which facilitates a culture in which the university is not obliged to critically analyse the extent to which they are creating obstacles that may be unnecessary (Zembylas, 2020).

To counteract this narrative, this study adopts a curriculum infusion approach. Curriculum infusion is the practice of embedding authentic, discipline-relevant materials and activities within the curriculum, aiming to encourage discussion and reflection on mental health and wellbeing within the context of the discipline being studied (Olson and Riley, 2009; Houghton and Anderson, 2017; Valtin, McWilliams and Ebenbach, 2018). It retains a focus on student voice, discussion and collaboration, adopting a positive, student-centered model of wellbeing rather than a deficit model focusing on academic achievement. In this study, the focus on resilience drew heavily on findings around growth mindset, an approach which has been shown in multiple studies to improve students' wellbeing and motivation (Dweck and Yeager, 2019; Yeager *et al.*, 2019). This study was particularly relevant to the degree's discipline as mental resilience was discussed in relation to the impact on brain function of the different interventions studied.

Methods

This study aimed to identify whether a curriculum infusion initiative would have a positive impact on students' resilience, as measured by the Resilience Scale for Young Adults (RSYA) (Prince-Embury, Saklofske and Nordstokke, 2017).

The intervention included a series of 'Neurobiology of resilience' workshops, infused into the core (compulsory) curriculum and combined with reflective activities and skill-based sessions to support the development of a growth mindset (Dweck, 2017). The 'neurobiology of resilience' workshops consisted of two

compulsory sessions as part of the 'Higher Skills in Neuroscience' module delivered at the start of the second year (out of three) of the degree. The workshops focused on neuroplasticity and non-pharmacological interventions shown to improve mental health. These workshops did not teach the interventions (e.g. exercise, mindfulness), but presented peer-reviewed evidence (e.g. meta-analysis) showing the positive impact of these interventions on mental health, with discussions of some of the neuronal mechanisms underlying their positive effects (e.g. vagus nerve activation or adult neurogenesis).

Group discussions were encouraged within the sessions, with a focus on the data and mechanisms/brain systems involved, and later the content was assessed in a summative exam (meaning all students were required to engage with the content, not only those with an interest in mental wellbeing or resilience). While the focus of the sessions was on neuroplasticity and the molecular and cellular mechanisms, students also learned about actions they could take to improve their mental wellbeing (i.e. physical exercise, mindfulness, yoga or adopting a growth mindset).

In detail: the first session focused on neuroplasticity, where students learned about the ability of the brain to change (number of new neurones, synapses or strength in connectivity) in response to the environment and/or actions taken by the individual. Afterwards students learned about growth mindset vs fixed mindset, the impact of mindset on wellbeing and success (Dweck, 2017) and the differences in brain activation between the two mindsets. Students learned that a person with a growth mindset believes that intelligence can be changed with experience and learning, while individuals with a fixed mindset believe intelligence is a fixed entity.

The next week students learned about the positive impact of physical (aerobic) exercise on depression, anxiety, memory and attention, using data from systematic reviews. This was followed by learning about the increase in adult neurogenesis and levels of growth factors in specific areas of the brain following physical exercise. The next week students received a summary on contemplative practices and learned, from systematic reviews, about the a) beneficial impact of mindfulness practices and yoga on anxiety and depression and b) brain changes associated with

these practices. The role of the vagus nerve and thalamic GABA levels in mediating these changes was described in more detail.

The last week focused on sleep. Students learned about the circuits and molecules relevant to determine the awake/sleep state of the individual (circadian rhythm, blue light/melatonin and caffeine/adenosine). Data from systematic reviews on the impact of lack of sleep, sleep stages and their changes with age was discussed. At the end of each session evidence-based advice on how to maximise the benefits of each intervention on mental health was given to students. Additionally, further 'learning' resources were made available for students who wanted to further explore the subjects.

The participants consisted of neuroscience students at the University of Nottingham during the academic years 2018–19 and 2019–20. The 2019–20 cohort received the 'neurobiology of resilience' curriculum infusion programme; the 2018–19 cohort did not receive these sessions, and therefore form the control group against which the 19–20 cohort is measured.

This study compares the outcomes of two surveys that took place in the academic years 2018–10 and 2019–20. Students were surveyed to assess different aspects of mental resilience and lifestyle choices shown to affect mental health. The survey consisted of the Resilience Scale for Young Adults (RSYA) (Prince-Embury, Saklofske and Nordstokke, 2017), aiming to measure mental resilience (sense of mastery, sense of relatedness and emotional reactivity). It also contained questions about lifestyle choices (e.g. physical activity, sleep, mindfulness) and two questions aiming to measure growth mindset (Dweck, 2017; Yeager *et al.*, 2019).

The surveys were given to students at a compulsory session in early March, after they received the marks for their autumn exams. In order to promote participation, three Amazon vouchers (£15 each) were raffled between participants. All surveys were anonymised; the first page (containing the consent form and, if included, name/email to enter the Amazon raffle) was removed before any processing or analysis of the data took place. When the survey was administered, students were reminded that participation was voluntary and that their grades would not be affected by their decision. The surveys to both cohorts were

identical, and students received a participant information sheet at least 24 hours before the survey was administered. Due to the small number of participants, we are unable to share individual demographic characteristics, as this could lead to identification of individual students. However, in terms of numbers of students considered to be WP students, the aggregated demographic characteristics of the entire 2018–19 class are 26% WP, 66% non-WP and 9% non-applicable, while for the 2019–20 class was 22% WP, 67% non-WP and 12% non-applicable.

Data was processed using Microsoft Excel. To analyse the RSYA survey items, i.e. to compare the 2018–19 and 2019–20 data, the *t*-test was used to analyse changes in the three resilience factors, while the Mann-Whitney test was used to analyse the changes in the 10 subclasses. Lifestyle and growth mindset data was analysed using the Mann-Whitney test. Statistical analysis was performed using Prism 9.0 (GraphPad Software, USA). Statistics reported in the text and figures represent the mean \pm S.E.M.. For all tests, null hypotheses were rejected at a probability level of $p < 0.05$.

Additionally, anonymised extenuating circumstances (EC) claims submitted during academic years 2017–18, 2018–19 and 2019–20 were coded into categories based on the statement of impact using a 'reflexive thematic analysis' approach (Braun and Clarke, 2019). ECs are claims in UK universities where students ask for an extension of coursework deadline or a new opportunity to perform an exam because their academic progress has been affected by circumstances outside their control. In the 'statement of impact' the student has to describe the circumstances (outside their control) that have had a negative impact on their studies). These statements of impact were used to perform the reflective thematic assessment, where a researcher classified the EC into: Bereavement (the death of a loved one had a negative impact on the student); Caregiving (student had a significant caregiving responsibility that prevented them to fully focus on their studies); Crime (student had been a victim of crime); External circumstances (e.g. a snow storm that prevented arrival at the location where the exam took place); Lack of adjustments (e.g. student that was entitled to extra time in exams, due to a learning difference, was not given it, usually due to late creation of a support plan); Mental (significant mental illness); Physical

(significant physical illness); Technical (e.g. student's laptop performing a backup during an online exam); Covid-external (e.g. overseas students having to quarantine when returning home at facilities with poor Wi-Fi connection due to local Covid-rules); Covid-mental (student's mental wellbeing significantly affected by to the ongoing Covid pandemic) and Covid-physical (students having Covid or Covid-like symptoms). For statements where more than one theme was mentioned, all themes were recorded, in line with Braun and Clarke's approach.

The study was approved by the Research Ethics Committee of the School of Life Sciences and the Faculty of Medicine and Health Sciences, University of Nottingham.

Results

Twenty-eight students (48.3% of eligible students) completed the survey in the academic year 2018–19 and 42 students (53.8% of eligible students) completed the survey in the academic year 2019–20. Due to the small population and the subsequent risk of identification, demographic details were not captured. For the aggregated WP demographic details of the cohorts, see the Methods section.

Resilience levels

The first key finding was that 2019–20 students (students who received the curriculum infusion intervention) showed significantly higher mental resilience in the Sense of Mastery factor [$t(68)=2.402$, $p=0.0191$] than 2018–19 students (who had not received the interventions) (see Figure 1).

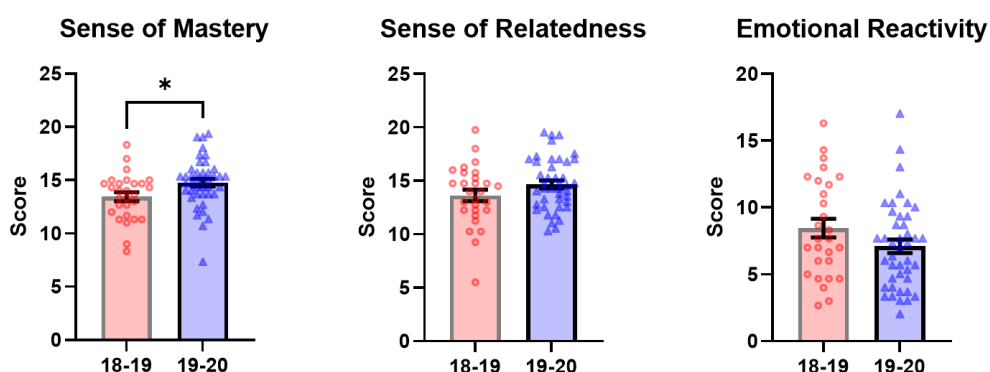


Figure 1: Mastery, relatedness, and reactivity by cohort (2018–19 n=28; 2019–20 n=42) * $p < 0.05$

Within the Sense of Mastery dimension, there was a significant increase in the 'optimism' [$U=405.5$, $p=0.0272$] and 'adaptability' [$U=384$, $p=0.0132$] subscales for the students who experienced the curriculum infusion programme (see Figure 2).

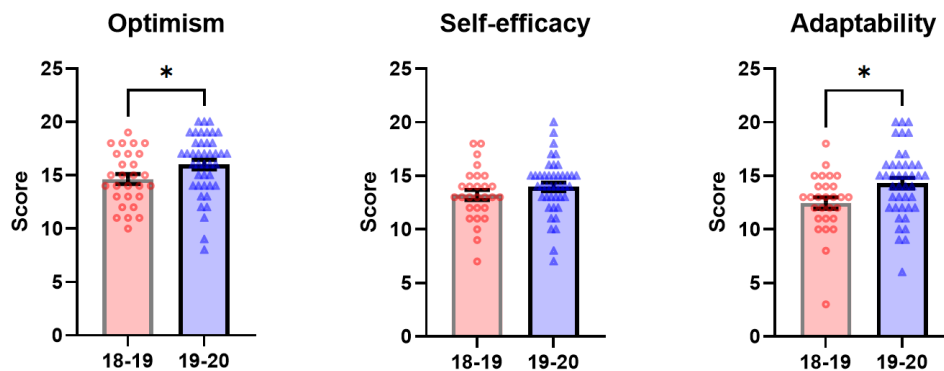


Figure 2: Sense of Mastery (optimism, self-efficacy, and adaptability) by cohort (2018–19 n=28; 2019–20 n=42) * $p < 0.05$

In addition to this finding, within the Emotional Reactivity factor there is a significant decrease on the impairment subscale [$U=413.5$, $p=0.0349$] for students who experienced the curriculum infusion programme, implying a stronger resilience to adverse circumstances (see Figure 3).

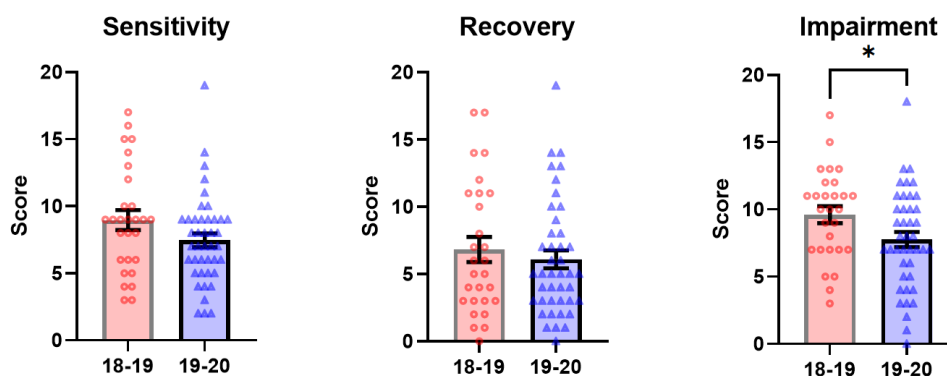


Figure 3: Emotional reactivity (sensitivity, recovery, and impairment) by cohort (2018–19 n=28; 2019–20 n=42) * $p < 0.05$

There was no significant difference for the subscales comprising the Sense of Relatedness factor, but there was a tendency towards more positive responses in the 'access to support' area for the students who received the curriculum infusion programme [$U=446$, $p=0.0876$] (see Figure 4).

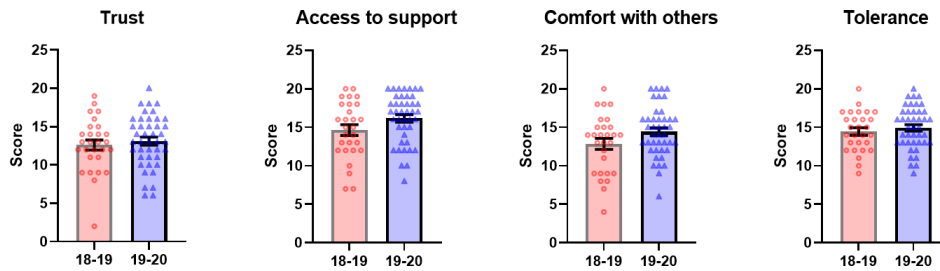


Figure 4: Sense of Relatedness by (2018–19 $n=28$; 2019–20 $n=42$)

Lifestyle choices

Students receiving the intervention did not differ in how important they thought exercise, mindfulness, sleep and grades were for their mental wellbeing (Figure 5). Additionally, there was no significant difference in the lifestyle choices between students who received or did not receive the 'neurobiology of resilience' programme (Figure 6).

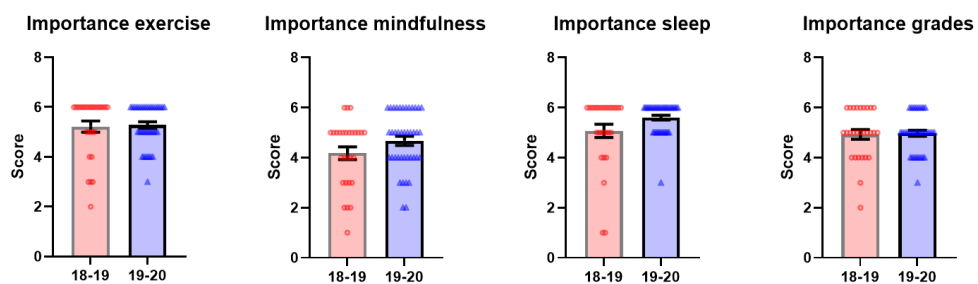
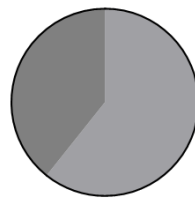


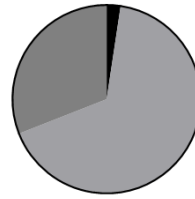
Figure 5: Lifestyle choices and wellbeing by cohort(2018–19 $n=28$; 2019–20 $n=42$)

Exercise



2018-19 (n=28)

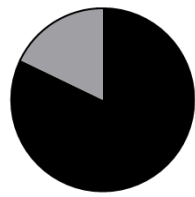
■ Moderately active (60.7%)
 ■ Very active (39.3%)



2019-20 (n=42)

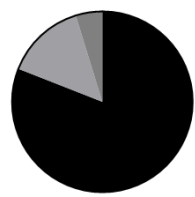
■ No active (2.4%)
 ■ Moderately active (66.6%)
 ■ Very active (31.0%)

Yoga



2018-19 (n=28)

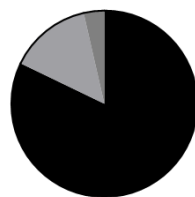
■ Weekly (17.9%)
 ■ Rarely (82.1%)



2019-20 (n=42)

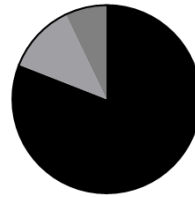
■ Daily (4.7%)
 ■ Weekly (14.3%)
 ■ Rarely (81.0%)

Meditation



2018-19 (n=28)

■ Daily (3.6%)
 ■ Weekly (14.3%)
 ■ Rarely (82.1%)



2019-20 (n=42)

■ Daily (7.1%)
 ■ Weekly (11.9%)
 ■ Rarely (81.0%)

Figure 6: Self-reported levels of exercise, yoga and meditation practice

Growth mindset

Students receiving and not receiving the intervention did not show significantly different results regarding development of growth mindset. The two questions have been frequently used in growth mindset literature (e.g. Limeri *et al.*, 2020) and relate to perceptions of intelligence: 1) Intelligence is something that cannot be changed very much and 2) You can learn new things, but you can't change a person's intelligence (Figure 7).

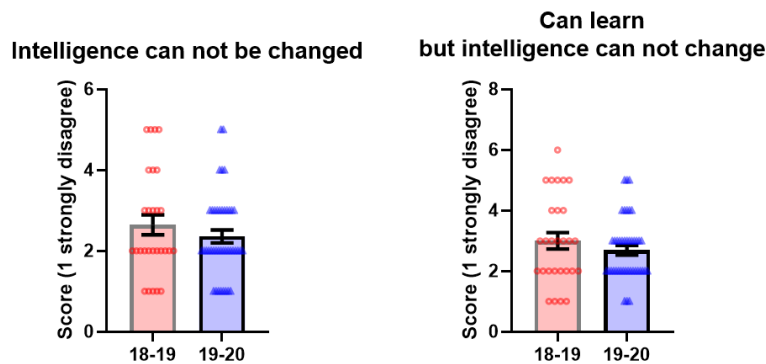


Figure 7: Growth mindset (student’s views on whether intelligence can be changed) by cohort (2018–19 n=28; 2019–20 n=42)

Reduction in extenuating circumstances claims

There was a 21.5% decrease in the number of extenuating circumstances claims (ECs) submitted by students in the 19–20 cohort; 42 ECs were submitted by the 18–19 cohort compared to 33 submitted by the 19–20 cohort. The reduction was more significant in the number of ECs submitted on the grounds of mental health-related issues; 16 were submitted by the 18–19 cohort compared to three submitted by the 19–20 cohort, a reduction of 81.3%. This translates to a 44.2 percentage point reduction in the proportion of the ECs submitted on mental health grounds, from 53.3% in the 2018–19 cohort to 9.1% in the 2019–20 cohort (see Figure 8). However, five additional students in the 2019–20 cohort submitted ECs on the grounds of poor mental health as a result of the pandemic and/or pandemic-related restrictions (15.1% of the total ECs, see Figure 8).

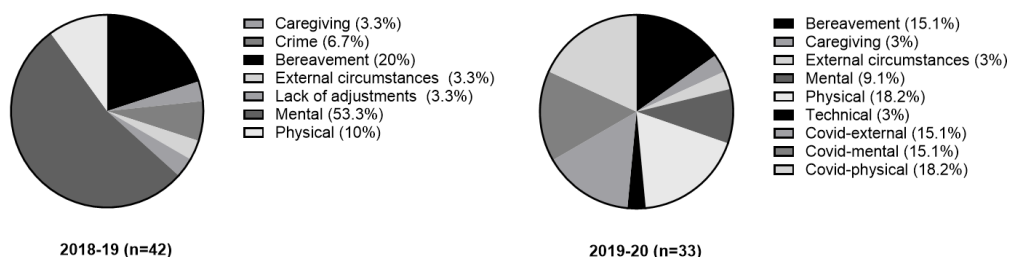


Figure 8: Thematic analysis of extenuating circumstances claims by cohort

To provide further comparison, and in order to determine whether the decrease in ECs and mental health-related ECs was due to the pandemic or the interventions, we also analysed the ECs for a cohort of final year students on two different programmes: biology and biochemistry. While there was a slight decrease (11%) in the number of ECs in the biology degree (110 in 2018–19 vs 98 in 2019–20), the biochemistry degree showed a substantial *increase* (51%) in the number of ECs submitted (38 in 2018–19 vs 74 in 2019–20). In both cases there was a decrease in the number of ECs submitted on the grounds of mental health; 22.9 percentage points in biochemistry (42.1% in 2018–19 vs 19.2% in 2019–20) and 24.9 percentage points in biology (44.5% in 2018–19 vs 19.6% in 2019–20.) However, these decreases were not as substantial as the 44.2 percentage point decrease for the neuroscience students, who are the focus of this study.

Discussion

The results of this study seem to imply that a curriculum infusion approach to embedding wellbeing appears to increase certain aspects of the mental resilience of undergraduate neuroscience students. Additionally, a substantial decrease in the number of extenuating circumstance applications submitted on the grounds of poor mental health has been noted, which might have also been related to the curriculum infusion intervention. This supports the contention found in the literature that a curriculum infusion approach can promote student wellbeing (Houghton and Anderson, 2017), and that teaching resilience can result in improved retention and decreases in extenuating circumstance claims (Cotton, Nash and Kneale, 2017).

The dimension with the strongest improvement in resilience was the Sense of Mastery area, in particular Optimism and Adaptability. This supports the findings of Wilson et al., who posited that Sense of Mastery was the dimension most likely to adapt or fluctuate according to circumstances, implying greater likelihood of showing change in response to a specific intervention (Wilson *et al.*, 2019). The increase in optimism is also particularly interesting in relation to the reduction in EC claims, as studies

have found a correlation between a high sense of optimism and low task avoidance (Nurttala, Ketonen and Lonka, 2015). Studies have placed high value on the importance of optimism and resilience for university students (Gómez-Molinero *et al.*, 2018) and on the positive impact on skills relating to adaptability in a higher education context (Fullerton, Zhang and Kleitman, 2021).

The curriculum infusion approach (Houghton and Anderson, 2017; Valtin, McWilliams and Ebenbach, 2018) adopted in this study focused on academic concepts of wellbeing habits and resilience and their neurological benefits. This meant that students improved their mental health literacy (Whitley *et al.*, 2018) while not being didactically taught how to improve their mental resilience. For example, by starting the sessions discussing neuroplasticity, students understood that change can happen in the way their brains are wired and function. By describing the molecular and cellular mechanisms underlying the positive effects of exercise, mindfulness, yoga, sleep and mindset, students were taught that there was a logical, scientific explanation to wellness practices that may invoke scepticism if taught didactically (Subramanian and Midha, 2016). This may have played a role in reaching 'hard to reach' (Shaw *et al.*, 2017) students, who can be more likely to reject interventions badged as 'mental health' (Byrom, 2018), many of whom are WP students (Turner *et al.*, 2007; Soorkia, Snelgar and Swami, 2011; Sancho and Larkin, 2020). Additional studies are needed to investigate this further. In particular, this approach might have benefited non-traditional students and students from minorities or disadvantaged groups, via strengthening of their internal locus of control (Rotter, 1966). This could happen because the sessions conveyed to students the actions they could take to improve their resilience and mental health regardless of their ethnicity, socio-economic status or circumstances in life.

It is interesting that the curriculum infusion intervention did not result in changes to students' perceptions of intelligence that would be indicative of a development of growth mindset. Sadly, this supports the findings of other studies that identified a shift in student perceptions away from a growth mindset and towards a more fixed mindset as they progress through higher education (Limeri *et al.*, 2020), despite the large amount of literature

discussing the benefits of students developing a growth mindset (Blake and Illingworth, 2015; Hochanadel and Finamore, 2015).

The EC collection period for the last cohort included the first Covid-19 lockdown in the UK, and we have to consider whether this may have affected the EC data to some extent. For example, due to the pandemic, the 2019–20 data also contained Covid-specific categories in the thematic analysis, and it may be that students cited Covid-19 as a cause for extenuating circumstances instead of mental health-related issues. However, even if Covid-related ECs are removed from the analysis, there is still a decrease in the percentage of ECs on the basis of mental health (27.5% in biochemistry, 34,5% in biology and 18.7% in neuroscience).

Regarding the survey results, we believe that they were not affected by the pandemic, as the 19–20 student survey took place in the first week of March 2020, when the pandemic was not yet affecting the UK to any serious extent (the first lockdown was announced on 23 March 2020). Indeed, anecdotal accounts of discussions with students a week after the survey was taken indicate that students felt they were not at risk from the pandemic and did not believe there was going to be a lockdown.

It is important to note that the curriculum infusion programme was not the only intervention in 2019–20 that may have had an impact on students' resilience or mental health. Indeed, while the decrease in ECs was stronger for neuroscience students, we also found a decrease (although smaller) in the number of ECs submitted on mental health grounds in the 19–20 cohort (for biochemistry, biology and neuroscience degrees). This could be due to the fact that the school is making an increasing and ongoing effort to improve student welfare provision and tutoring support in the school, taking a more proactive approach to identifying students who need help and referring them to the relevant support services at an earlier point. Additionally, the Covid pandemic has shaken to the core the way of life and expectations of staff and students alike. For many, it may be an opportunity to put into perspective previous goals and challenges, and a chance to increase resilience and adaptability. Thus, we should be mindful of these external circumstances when analysing our data, as they could affect the students' resilience level. In

particular they might explain, at least in part, the decrease in mental health-related ECs in the biochemistry and biology cohorts. However, the fact that the decrease in the neuroscience students was significantly larger than in the biochemistry and biology students (who did not receive the intervention) seems to indicate that the neurobiology of resilience sessions also had a positive effect on students' mental resilience. It could be argued that students in different degrees experience different teaching and learning, but this fact was taken into consideration in our analysis by comparing the change in ECs within each degree. Therefore, our results imply that the curriculum infusion intervention has made a positive contribution to students' resilience.

Conclusion

This paper has reported findings from a UK study in a Russell Group university that aimed to embed mental wellbeing and resilience skills within the neuroscience curriculum using a 'curriculum infusion' approach. Students who received, and did not receive, the intervention were surveyed using the Resilience Scale for Young Adults, as well as questions on lifestyle and growth mindset. The comparison of results indicated that students receiving the curriculum infusion programme showed significantly higher mental resilience in terms of optimism, adaptability and a decrease in emotional reactivity. Additionally, a thematic analysis was carried out on extenuating circumstances (EC) claims placed to identify changes in the number of mental health-related claims; this found a lower proportion of mental health-related ECs in the group receiving the intervention.

There were a number of limitations to the study. The cohort of students was small, and the EC collection period included the early stages of the Covid-19 pandemic (pre-lockdown), which presented challenges for the study and may have affected the results. Furthermore, the intervention took place in one school, within one institution. Moreover, this intervention did not aim to replace professional care for students with mental health disorders. It focused on enabling students to maintain good mental health alongside the usual challenges of studying an undergraduate degree. More research is needed to further

investigate curriculum infusion approaches and student wellbeing in different contexts and institutions, in order to identify whether this approach is truly effective in improving mental wellbeing and resilience.

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