**Supplementary results**

|  |  |  |
| --- | --- | --- |
| ***Lesson***  | ***Anxiety***  | ***Depression***  |
| 1 | Identifying anxiety  | Identifying first stages of depression  |
| 2 | Realistic thinking  | Pleasant event scheduling  |
| 3 | Facing fears  | Negative thinking habits  |
| 4 | Assertiveness  | How to change negative thinking habits |
| 5 | Prediction testing  | Responding to stressful situations/Structured problem solving  |
| 6 | Review and help seeking  | Putting it all together  |
| **Table S1**. Topics covered in *Climate Mental Health* lesson, targeting anxiety and depression.  |

|  |  |  |
| --- | --- | --- |
|  | **Control** | **Climate Mental Health** |
|  | *Mean* | *SD* | *Mean* | *SD* |
|  | % Yes (N) | % No (N) | % Yes (N) | % No (N) |
| Probable depression |  |  |  |  |
| Baseline  | 16.5% (206) | 83.5% (1040) | 17.1% (291) | 82.9% (1414) |
| Post-intervention  | 17.3% (220) | 82.7% (1049) | 18.2% (232) | 81.8% (1042) |
| 6 months  | 16.1% (207) | 83.9% (1078) | 17.3% (198) | 82.7% (946) |
| 12 months  | 17.5% (201) | 82.5% (949) | 18.8% (205) | 81.2% (884) |
| 18 months  | 19.6% (205) | 80.4% (843) | 18.7% (190) | 81.3% (824) |
| Probable anxiety |  |  |  |  |
| Baseline  | 12.3% (153) | 87.7% (1092) | 14.5% (248) | 85.5% (1459) |
| Post-intervention  | 12.8% (162) | 87.2% (1107) | 15.1% (192) | 84.9% (1080) |
| 6 months  | 13.1% (168) | 86.9% (1115) | 14.1% (161) | 85.9% (984) |
| 12 months  | 12.6% (145) | 87.4% (1004) | 13.3% (145) | 86.7% (944) |
| 18 months  | 15.4% (161) | 84.6% (885) | 14.4% (145) | 85.6% (865) |

**Table S2**: Percentage of participants reporting probable depression and anxiety across time and by condition.

**Hypothesis one**

**Continuous outcome measures**

|  |  |
| --- | --- |
|  | **Internalising problems (inc. gender)** |
| *Predictors* | *Estimates* | *CI* | *p* | *Cohen’s d* |
| Intercept | 5.21 | 4.83 – 5.59 | **<0.001** | **-** |
| 6 months | -0.14 | -0.35 – 0.08 | 0.208 | -.03 |
| 12 months | 0.18 | -0.04 – 0.40 | 0.105 | .04 |
| 18 months | 0.55 | 0.33 – 0.78 | **<0.001** | **.12** |
| Condition (Mental Health) | 0.00 | -0.51 – 0.51 | 0.994 | .002 |
| Gender (Male) | -0.84 | -1.10 – -0.58 | **<0.001** | **-.26** |
| 6 months x Condition (Mental Health) | 0.67 | 0.37 – 0.96 | **<0.001** | **.11** |
| 12 months x Condition (Mental Health) | 0.38 | 0.07 – 0.68 | **0.017** | **.06** |
| 18 months x Condition (Mental Health) | 0.16 | -0.16 – 0.47 | 0.331 | .02 |
| **Random Effects** |  |
| σ2 | 6.89 |  |
| τ00 Student ID: School | 7.15 |  |
| τ00 School | 0.42 |  |
| ICC | 0.52 |  |
| N Student ID | 3289 |  |
| N School | 39 |  |
| Observations | 9625 |  |
| Marginal R2 / Conditional R2 | 0.017 / 0.532 |  |
| **Table S3**: Model estimates for internalising problems, when controlling for gender. σ2 represents the residual variance, unexplained by the predictors in the model. τ00 represents the between subject variance. |

***Internalising problems, controlling for gender.*** Omnibus tests revealed a significant time by condition interaction (*F*=(3, 6736)=7.96, *p*<.001) and a main effect of time (*F*=(3, 6737)=22.0, *p*<.001) and gender (*F*=(1, 2375)=39.42, *p*<.001). There was no significant main effect of condition (*F*=(1, 39)=1.51, *p*=.23). Model estimates are reported in table S3.

|  |  |  |
| --- | --- | --- |
|  | **Depressive symptoms (inc. gender)** | **Depressive symptoms (inc. baseline anxiety)** |
| *Predictors* | *Estimates* | *CI* | *p* | *Cohen’s d* | *Estimates* | *CI* | *p* | *Cohen’s d* |
| Intercept | 5.56 | 5.10 – 6.01 | **<0.001** | - | 2.39 | 2.01 – 2.77 | **<0.001** | - |
| Post-intervention | 0.37 | 0.05 – 0.69 | **0.023** | .05 | 0.36 | 0.03 – 0.68 | **0.031** | .05 |
| 6 months | -0.03 | -0.35 – 0.29 | 0.852 | -.004 | 0.02 | -0.30 – 0.34 | 0.904 | .003 |
| 12 months | -0.07 | -0.40 – 0.25 | 0.658 | -.009 | -0.05 | -0.38 – 0.28 | 0.760 | -.01 |
| 18 months | 0.65 | 0.31 – 0.98 | **<0.001** | .08 | 0.63 | 0.29 – 0.98 | **<0.001** | .08 |
| Condition (Mental Health) | 0.29 | -0.30 – 0.89 | 0.336 | .28 | 0.00 | -0.49 – 0.50 | 0.993 | .002 |
| Gender (Male) | -2.08 | -2.45 – -1.71 | **<0.001** | -.62 | - | - | - | - |
| Baseline GAD Anxiety  | - | - | - | - | 0.63 | 0.61 – 0.66 | **<0.001** | 1.75 |
| Post-intervention x Condition (Mental Health) | -0.30 | -0.74 – 0.15 | 0.192 | -.03 | -0.32 | -0.76 – 0.12 | 0.156 | -.03 |
| 6 months x Condition (Mental Health) | -0.03 | -0.48 – 0.42 | 0.893 | -.003 | -0.04 | -0.49 – 0.41 | 0.847 | -.004 |
| 12 months x Condition (Mental Health) | 0.07 | -0.39 – 0.53 | 0.770 | .006 | 0.10 | -0.36 – 0.56 | 0.666 | .01 |
| 18 months x Condition (Mental Health) | -0.21 | -0.68 – 0.27 | 0.394 | -.02 | -0.10 | -0.58 – 0.37 | 0.666 | -.01 |
| **Random Effects** |
| σ2 | 15.94 | 15.38 |
| τ00 Student ID: School | 15.97 | 7.61 |
| τ00 School | 0.42 | 0.26 |
| ICC | 0.51 | 0.34 |
| N Student ID | 3321 | 295 |
| N School | 39 | 39 |
| Observations | 12224 | 11161 |
| Marginal R2 / Conditional R2 | 0.030 / 0.522 | 0.289 / 0.530 |
| **Table S4**: Model estimates for depressive symptoms, when controlling for gender and baseline anxiety symptoms. σ2 represents the residual variance, unexplained by the predictors in the model. τ00 represents the between subject variance. |

***Depression, controlling for gender.*** Omnibus tests revealed no significant time by condition interaction (*F*=(4, 9250)=0.84, *p*=.50) and no significant main effect of condition (*F*=(1, 33)=.53, *p*=.47). There was a significant main effect of time (*F*=(4, 9249)=8.34, *p*<.001) and gender (*F*=(1, 1279)=121.05, *p*<.001). Model estimates are reported in table S4.

***Depression, controlling for baseline anxiety.*** Omnibus tests revealed no significant time by condition interaction (*F*=(4, 8674)=.86, *p*=.49) and no significant main effect of condition (*F*=(1, 34)=.10, *p*=.75). There was a significant main effect of time (*F*=(4, 8673)=7.78, *p*<.001) and baseline anxiety (*F*=(1,2974)=2272.03, *p*<.001). Model estimates are reported in table S4.

|  |  |  |
| --- | --- | --- |
|  | **Anxiety symptoms (inc. gender)** | **Anxiety symptoms (inc. baseline depression)** |
| *Predictors* | *Estimates* | *CI* | *p* | *Cohen’s d* | *Estimates* | *CI* | *p* | *Cohen’s d* |
| Intercept | 4.57 | 4.17 – 4.96 | **<0.001** | - | 1.40 | 1.09 – 1.71 | **<0.001** | - |
| Post-intervention | 0.18 | -0.11 – 0.46 | 0.220 | .03 | 0.21 | -0.08 – 0.49 | 0.158 | .03 |
| 6 months | -0.05 | -0.34 – 0.23 | 0.719 | -.01 | -0.02 | -0.31 – 0.26 | 0.876 | -.003 |
| 12 months | -0.11 | -0.40 – 0.18 | 0.467 | -.02 | -0.03 | -0.32 – 0.27 | 0.865 | -.004 |
| 18 months | 0.64 | 0.34 – 0.94 | **<0.001** | .09 | 0.64 | 0.33 – 0.94 | **<0.001** | .09 |
| Condition (Mental Health) | 0.31 | -0.21 – 0.83 | 0.244 | .33 | 0.14 | -0.25 – 0.54 | 0.485 | .19 |
| Gender (Male) | -1.88 | -2.21 – -1.56 | **<0.001** | -.66 | - | - | - | - |
| Baseline PHQ Depression | - | - | - | - | 0.52 | 0.49 – 0.54 | **<0.001** | 1.74 |
| Post-intervention x Condition (Mental Health) | 0.07 | -0.32 – 0.46 | 0.730 | .01 | 0.06 | -0.34 – 0.45 | 0.783 | .01 |
| 6 months x Condition (Mental Health) | 0.06 | -0.34 – 0.46 | 0.776 | .01 | 0.07 | -0.33 – 0.47 | 0.741 | .01 |
| 12 months x Condition (Mental Health) | 0.04 | -0.37 – 0.45 | 0.858 | .004 | 0.01 | -0.40 – 0.42 | 0.976 | .001 |
| 18 months x Condition (Mental Health) | -0.28 | -0.70 – 0.14 | 0.198 | -.03 | -0.24 | -0.66 – 0.18 | 0.264 | -.02 |
| **Random Effects** |
| σ2 | 12.59 | 12.17 |
| τ00 Student ID: School | 12.75 | 6.16 |
| τ00 School | 0.29 | 0.12 |
| ICC | 0.51 | 0.34 |
| N Student ID | 3320 | 2949 |
| N School | 39 | 39 |
| Observations | 12215 | 11150 |
| Marginal R2 / Conditional R2 | 0.032 / 0.524 | 0.292 / 0.533 |
| **Table S5**: Model estimates for anxiety symptoms, when controlling for gender and baseline depressive symptoms. σ2 represents the residual variance, unexplained by the predictors in the model. τ00 represents the between subject variance. |

***Anxiety, controlling for gender.*** Omnibus tests revealed no significant time by condition interaction (*F*=(4, 9244)=0.84, *p*=.50) and no significant main effect of condition (*F*=(1, 33)=1.44, *p*=.24). There was a significant main effect of time (*F*=(4, 9243)=9.71, *p*<.001) and gender (*F*=(1, 1166)=125.91, *p*<.001). Model estimates are reported in table S5.

***Anxiety, controlling for baseline depression.*** Omnibus tests revealed no significant time by condition interaction (*F*=(4, 8572)=0.59, *p*=.67) and no significant main effect of condition (*F*=(1, 28)=.49, *p*=.49). There was a significant main effect of time (*F*=(4,8571)=8.31, *p*<.001) and baseline depression (*F*=(1,3001)=2271.89, *p*<.001). Model estimates are reported in table S5.

**Binary outcomes measures**

***Probable depression and anxiety****.* We conducted two generalised linear mixed models in which we predicted probable depression and probable anxiety (defined as depressed/anxious or not), however, these models did not converge, and did not respond to optimisation. Therefore, we ran a number of generalised estimating equations, with a logit link, which account for change in within subject correlations over time. For depression, omnibus Wald statistic tests revealed no statistically significant time by condition interaction (*X2*(4)= 1.66*, p*=.80) and no main effect of time (*X2*(4)=9.10*, p*=.06) and no main effect of condition (*X2*(1)= .39*, p*=.53). For anxiety, omnibus Wald statistic tests revealed no statistically significant time by condition interaction (*X2*(4)= 4.51*, p*=.34) and no main effect of time (*X2*(4)=5.54*, p*=.24) and no main effect of condition (*X2*(1)= 1.58*, p*=.21). Model estimates for both models are reported in table S6. See supplementary table S7 and S8 for the results of these analyses when controlling for gender and baseline anxiety and depression.

|  |  |  |
| --- | --- | --- |
|  | **Depression** | **Anxiety** |
| *Predictors* | *Estimate* | *SE* | *Wald* | *P* | *Odds Ratio* | *Estimate* | *SE* | *Wald* | *P* | *Odds Ratio* |
| Intercept | -1.62 | .08 | 450.74 | **<.001** | 0.20 | -1.97 | 0.09 | 518.34 | **<.001** | 0.14 |
| Post-intervention | 0.06 | 0.08 | 0.47 | 0.50 | 1.06 | 0.04 | 0.10 | 0.19 | 0.67 | 1.04 |
| 6 months | -0.03 | 0.09 | 0.13 | 0.72 | 0.97 | 0.07 | 0.10 | 0.55 | 0.46 | 1.08 |
| 12 months | 0.07 | 0.09 | 0.52 | 0.47 | 1.07 | 0.03 | 0.11 | 0.08 | 0.78 | 1.03 |
| 18 months | 0.21 | 0.09 | 4.43 | **0.04** | 1.23 | 0.26 | 0.11 | 5.67 | **0.02** | 1.30 |
| Condition (Mental Health) | 0.04 | 0.10 | 0.15 | 0.70 | 1.04 | 0.19 | 0.11 | 3.07 | 0.08 | 1.21 |
| Post-intervention x Condition (Mental Health) | 0.02 | 0.10 | 0.03 | 0.85 | 1.02 | 0.001 | 0.13 | 0.00 | 0.99 | 1.00 |
| 6 months x Condition (Mental Health) | 0.05 | 0.12 | 0.15 | 0.70 | 1.05 | -0.11 | 0.13 | 0.68 | 0.41 | 0.90 |
| 12 months x Condition (Mental Health) | 0.05 | 0.13 | 0.16 | 0.69 | 1.05 | -0.13 | 0.15 | 0.78 | 0.38 | 0.88 |
| 18 months x Condition (Mental Health) | -0.09 | 0.13 | 0.46 | 0.50 | 0.91 | -0.28 | 0.15 | 3.31 | 0.07 | 0.76 |
| **Table S6**: Generalised estimating equations predicting probable depression anxiety. |

|  |  |  |
| --- | --- | --- |
|  | **Depression (inc. gender)** | **Depression (inc. baseline anxiety)** |
| *Predictors* | *Estimate* | *SE* | *Wald* | *P* | *Odds Ratio* | *Estimate* | *SE* | *Wald* | *P* | *Odds Ratio* |
| Intercept | -1.46 | .08 | 339.40 | **<.001** | 0.23 | -2.73 | 0.08 | 1034.19 | **<.001** | 0.07 |
| Post-intervention | 0.08 | 0.08 | 0.84 | 0.36 | 1.08 | 0.13 | 0.10 | 1.51 | 0.22 | 1.14 |
| 6 months | -0.01 | 0.09 | 0.01 | 0.91 | 0.99 | 0.02 | 0.11 | 0.04 | 0.84 | 1.02 |
| 12 months | 0.07 | 0.09 | 0.50 | 0.48 | 1.07 | 0.11 | 0.12 | 0.94 | 0.33 | 1.12 |
| 18 months | 0.19 | 0.10 | 3.94 | **0.05** | 1.22 | 0.29 | 0.12 | 5.86 | **0.02** | 1.34 |
| Condition (Mental Health) | 0.11 | 0.10 | 1.29 | 0.26 | 1.12 | -0.5 | 0.10 | 0.26 | 0.61 | 0.95 |
| Gender (Male) | -0.78 | 0.08 | 77.94 | **<.001** | 0.51 | - | - | - | - | - |
| Baseline GAD Anxiety | - | - | - | **-** | - | 0.21 | 0.01 | 636.26 | **<.001** | 1.24 |
| Post-intervention x Condition (Mental Health) | -0.01 | 0.12 | 0.00 | 0.97 | 0.99 | -0.00 | 0.15 | 0.00 | 1.00 | 1.00 |
| 6 months x Condition (Mental Health) | 0.01 | 0.13 | 0.01 | 0.94 | 1.01 | -0.00 | 0.16 | 0.00 | 0.99 | 1.00 |
| 12 months x Condition (Mental Health) | 0.04 | 0.13 | 0.08 | 0.77 | 1.04 | 0.11 | 0.16 | 0.45 | 0.50 | 1.12 |
| 18 months x Condition (Mental Health) | -0.11 | 0.14 | 0.60 | 0.44 | 0.90 | -0.2 | 0.17 | 0.02 | 0.89 | 0.98 |
| **Table S7**: Generalised estimating equations predicting probable depression and controlling for gender and baseline anxiety.  |

***Probable depression, controlling for gender.*** Wald statistic tests revealed no significant time by condition interaction (*X2*(4)= 1.4*, p*=.84) and no main effect of time (*X2*(4)=9.1*, p*=.06) and no main effect of condition (*X2*(1)= .04*, p*=.53). There was a significant main effect of gender (*X2*(1)= .78.1*, p*<.001). Model estimates are reported in table S7.

***Probable depression, controlling for baseline anxiety.*** Wald statistic tests revealed no significant time by condition interaction (*X2*(4)= 1*, p*=.92) and no main effect of time (*X2*(4)=8*, p*=.10) and no main effect of condition (*X2*(1)= 0*, p*=.50). There was a significant main effect of baseline anxiety (*X2*(1)= 636*, p*<.001). Model estimates are reported in table S7.

|  |  |  |
| --- | --- | --- |
|  | **Anxiety (inc. gender)** | **Anxiety (inc. baseline depression)** |
| *Predictors* | *Estimate* | *SE* | *Wald* | *P* | *Odds Ratio* | *Estimate* | *SE* | *Wald* | *P* | *Odds Ratio* |
| Intercept | -1.81 | 0.09 | 413.21 | **<.001** | 0.16 | -3.24 | 0.10 | 1041.77 | **<.001** | 0.04 |
| Post-intervention | 0.06 | 0.10 | 0.38 | 0.54 | 1.06 | 0.07 | 0.13 | 0.29 | 0.59 | 1.07 |
| 6 months | 0.09 | 0.10 | 0.87 | 0.35 | 1.10 | 0.12 | 0.12 | 0.91 | 0.34 | 1.12 |
| 12 months | 0.03 | 0.11 | 0.07 | 0.79 | 1.03 | 0.11 | 0.14 | 0.69 | 0.41 | 1.12 |
| 18 months | 0.25 | 0.11 | 5.15 | **0.02** | 1.28 | 0.38 | 0.14 | 7.76 | **0.01** | 1.47 |
| Condition (Mental Health) | 0.27 | 0.11 | 5.77 | **0.02** | 1.31 | 0.19 | 0.11 | 3.03 | 0.08 | 1.21 |
| Gender (Male) | -0.64 | 0.08 | 59.70 | **<.001** | 0.53 | - | - | - | - | - |
| Baseline PHQ Depression | - | - | - | **-** | - | 0.19 | 0.01 | 528.20 | **<.001** | 1.21 |
| Post-intervention x Condition (Mental Health) | -0.25 | 0.14 | 0.03 | 0.86 | 0.98 | -0.00 | 0.17 | 0.00 | 1.00 | 1.00 |
| 6 months x Condition (Mental Health) | -0.15 | 0.14 | 1.21 | 0.27 | 0.86 | -0.11 | 0.17 | 0.42 | 0.52 | 0.90 |
| 12 months x Condition (Mental Health) | -0.15 | 0.15 | 0.97 | 0.32 | 0.86 | -0.16 | 0.19 | 0.72 | 0.40 | 0.85 |
| 18 months x Condition (Mental Health) | -0.29 | 0.15 | 3.62 | 0.06 | 0.75 | -0.31 | 0.19 | 2.66 | 0.10 | 0.73 |
| **Table S8**: Generalised estimating equations predicting probable anxiety and controlling for gender and baseline depression. |

***Probable anxiety, controlling for gender.*** Wald statistic tests revealed no significant time by condition interaction (*X2*(4)= 4.7*, p*=.32) and no main effect of time (*X2*(4)= 5.5*, p*=.24)) and no main effect of condition (*X2*(1)= 1.6*, p*=.21). There was a significant main effect of gender (*X2*(1)= .59.6*, p*<.001). Model estimates are reported in table S8.

***Probable anxiety, controlling for baseline depression.*** Wald statistic tests revealed no significant time by condition interaction (*X2*(4)= 3*, p*=.51) and no main effect of time (*X2*(4)=3*, p*=.48) and no main effect of condition (*X2*(1)= 3*, p*=.09). There was a significant main effect of baseline depression (*X2*(1)= 526*, p*<.001). Model estimates are reported in table S8.

**Hypothesis two**

Repeated analyses for subset of sample with social network data.

**Continuous outcomes**

|  |  |
| --- | --- |
|  | **Internalising problems** |
| *Predictors* | *Estimates* | *CI* | *p* | *Cohen’s d* |
| Intercept | 4.55 | 3.81 – 5.29 | **<0.001** | - |
| 6 months | 0.01 | -0.30 – 0.33 | 0.936 | .003 |
| 12 months | 0.41 | 0.07 – 0.74 | **0.017** | .10 |
| 18 months | 0.47 | 0.12 – 0.82 | **0.009** | .11 |
| Condition (Mental Health) | 0.41 | -0.77 – 1.58 | 0.496 | .45 |
| 6 months x Condition (Mental Health) | 0.45 | -0.05 – 0.96 | 0.080 | .07 |
| 12 months x Condition (Mental Health) | 0.46 | -0.07 – 0.99 | 0.086 | .07 |
| 18 months x Condition (Mental Health) | 0.51 | -0.04 – 1.06 | 0.067 | .08 |
| **Random Effects** |  |
| σ2 | 6.53 |  |
| τ00 Student ID: School | 7.63 |  |
| τ00 School | 0.69 |  |
| ICC | 0.56 |  |
| N Student ID | 1036 |  |
| N School | 10 |  |
| Observations | 3183 |  |
| Marginal R2 / Conditional R2 | 0.015 / 0.566 |  |
| **Table S9**: Model estimates for internalising problems, on the subset of sample with social network data. σ2 represents the residual variance, unexplained by the predictors in the model. τ00 represents the between subject variance. |

***Internalising problems.*** Omnibus tests revealed a main effect of time *F*(3, 2255)= 12.15, *p* <.001. All other fixed effects did not meet significance (*p* >.05). Model estimates are reported in table S9.

***Depressive symptoms.*** Omnibus tests revealed a main effect of time *F*(4, 3131)= 3.67 , *p =* .005 and a significant time by condition interaction *F*(4, 3131)= 3.29 , *p =* .01. All other fixed effects did not meet significance (*p* >.05). Model estimates are reported in table S10.

***Anxiety symptoms.*** Omnibus tests revealed a main effect of time *F*(4, 3139)= 6.22 , *p <* .001 and a significant time by condition interaction *F*(4, 3139)= 4.96 , *p <* .001. All other fixed effects did not meet significance (*p* >.05). Model estimates are reported in table S10.

|  |  |  |
| --- | --- | --- |
|  | **Depressive symptoms** | **Anxiety symptoms** |
| *Predictors* | *Estimates* | *CI* | *p* | *Cohen’s d* | *Estimates* | *CI* | *p* | *Cohen’s d* |
| Intercept | 4.55 | 3.67 – 5.43 | **<0.001** | - | 3.84 | 3.17 – 4.50 | **<0.001** | - |
| Post-intervention | 0.34 | -0.11 – 0.80 | 0.140 | .05 | 0.00 | -0.42 – 0.42 | 0.987 | -.001 |
| 6 months | -0.04 | -0.49 – 0.42 | 0.876 | -.006 | -0.23 | -0.65 – 0.18 | 0.272 | -.04 |
| 12 months | -0.08 | -0.56 – 0.40 | 0.742 | -.01 | -0.42 | -0.86 – 0.02 | 0.061 | -.07 |
| 18 months | 0.23 | -0.27 – 0.73 | 0.367 | .03 | 0.22 | -0.24 – 0.68 | 0.350 | .03 |
| Condition (Mental Health) | 0.43 | -0.98 – 1.83 | 0.550 | .37 | 0.12 | -0.95 – 1.18 | 0.828 | .013 |
| Post-intervention x Condition (Mental Health) | -0.06 | -0.79 – 0.67 | 0.875 | -.01 | 0.51 | -0.15 – 1.18 | 0.130 | .05 |
| 6 months x Condition (Mental Health) | 0.46 | -0.27 – 1.19 | 0.218 | .04 | 0.44 | -0.24 – 1.11 | 0.204 | .05 |
| 12 months x Condition (Mental Health) | 0.96 | 0.19 – 1.72 | **0.014** | .09 | 1.40 | 0.70 – 2.10 | **<0.001** | .14 |
| 18 months x Condition (Mental Health) | 1.03 | 0.24 – 1.83 | **0.011** | .09 | 1.18 | 0.45 – 1.91 | **0.002** | .11 |
| **Random Effects** |
| σ2 | 14.07 | 11.79 |
| τ00 Student ID: School | 15.91 | 12.86 |
| τ00 School | 0.87 | 0.41 |
| ICC | 0.54 | 0.53 |
| N Student ID | 1042 | 1042 |
| N School | 10 | 10 |
| Observations | 4104 | 4100 |
| Marginal R2 / Conditional R2 | 0.009 / 0.548 | 0.011 / 0.535 |
| **Table S10**: Model estimates for depressive and anxiety symptoms, on the subset of sample with social network data. σ2 represents the residual variance, unexplained by the predictors in the model. τ00 represents the between subject variance. |

**Binary outcomes**

|  |  |  |
| --- | --- | --- |
|  | **Depression** | **Anxiety** |
| *Predictors* | *Estimate* | *SE* | *Wald* | *P* | *Odds Ratio* | *Estimate* | *SE* | *Wald* | *P* | *Odds Ratio* |
| Intercept | -1.76 | 0.12 | 207.51 | **<.001** | 0.17 | -2.03 | 0.14 | 226.85 | **<.001** | 0.13 |
| Post-intervention | -0.32 | 0.14 | 0.05 | 0.82 | 0.97 | -1.17 | 0.17 | 1.02 | 0.31 | 0.84 |
| 6 months | -0.12 | 0.15 | 0.64 | 0.43 | 0.89 | -0.6 | 0.16 | 0.12 | 0.72 | 0.94 |
| 12 months | 0.01 | 0.15 | 0.00 | 0.96 | 1.01 | -0.17 | 0.18 | 0.84 | 0.36 | 0.85 |
| 18 months | 0.02 | 0.17 | 0.01 | 0.91 | 1.02 | 0.05 | 0.19 | 0.07 | **0.78** | 1.05 |
| Condition (Mental Health) | 0.19 | 0.18 | 1.07 | 0.30 | 1.21 | 0.17 | 0.20 | 0.72 | 0.40 | 1.19 |
| Post-intervention x Condition (Mental Health) | -0.03 | 0.22 | 0.02 | 0.89 | 0.97 | 0.12 | 0.26 | 0.22 | 0.64 | 1.13 |
| 6 months x Condition (Mental Health) | 0.03 | 0.23 | 0.02 | 0.88 | 1.03 | -0.81 | 0.25 | 0.11 | 0.75 | 0.92 |
| 12 months x Condition (Mental Health) | 0.22 | 0.23 | 0.92 | 0.34 | 1.25 | 0.24 | 0.27 | 0.76 | 0.38 | 1.27 |
| 18 months x Condition (Mental Health) | 0.30 | 0.25 | 1.43 | 0.23 | 1.35 | 0.33 | 0.27 | 1.46 | 0.23 | 1.39 |
| **Table S11**: Generalised estimating equations predicting probable depression and anxiety, on the subset of sample with social network data. |

***Probable depression.*** Wald statistic tests revealed no significant time by condition interaction (*X2*(4)= 3.01*, p*=.56) and no main effect of time (*X2*(4)= 7.35*, p*=.12)) and a significant main effect of condition (*X2*(1)= 4.90*, p*=.03). Model estimates are reported in table S11.

***Probable anxiety.*** Wald statistic tests revealed no significant time by condition interaction (*X2*(4)= 3.23*, p*=.52) and no main effect of time (*X2*(4)=7.23*, p*=.12) and a significant main effect of condition (*X2*(1)= 4.15*, p*=.04). Model estimates are reported in table S11.

|  |  |
| --- | --- |
| **Model** | **QIC** |
| Probable depression  |  |
| **Time x condition**  | **3602** |
| Time x condition x indegree centrality  | 3617.6 |
| Time x condition x betweenness centrality | 3614.7 |
| Probable anxiety  |  |
| **Time x condition**  | **3028** |
| Time x condition x indegree centrality  | 3033.2 |
| Time x condition x betweenness centrality | 3035 |

**Table S12**: QIC scores for models including an interaction with social network measures compared to a model without, for each binary outcome variable. Models were estimated using generalised estimating equations and were compared based on QIC criteria.

**Social network analysis**

Social network data was analysed using the igraph package (version 1.2.6) in R (version 4.0.2; R Core Team, 2021). At baseline, participants completed a social network survey in which they were asked to nominate up to 3 people with whom they spent most of their free time with from their year group. Only the names of participants who consented to participate in the CSC trial were included in the roster of names participants were allowed to nominate. Peer nominations were first turned into an unweighted edge list, representing all nominations made across the year group taken from each school. A directed social network was then constructed from the edge list, which included all participants who either nominated a peer, or received a nomination from a peer. Unstandardized measures of indegree centrality (number of nominations received) and betweenness centrality (the number of times an individual sat on the shortest path between two otherwise unconnected individuals) were then computed from the network. Participants who did not nominate any peers and who also did not receive a nomination received a score of zero on each measure of indegree centrality and betweenness centrality given their position within the social network as a total isolate (i.e., they had no inward or outward ties to other pupils in the network). This approach assumes that pupils who left the social network questions unanswered did so because they did not spend time with any of the pupils listed in the roster. Following this, indegree and betweenness centrality scores were standardised by school group, to account for differences in group size. Higher scores on each measure represent higher centrality, and therefore a higher degree of social connectedness.



**Figure S1**: Correlation plots between social network measures at baseline and outcome measures of internalising, depressive (PHQ) and anxiety (GAD) symptoms at baseline. The relationship between outcome measures and indegree centrality are shown in panels A-C, and between outcome measures and betweenness centrality between panels D-F.

**Additional analyses**

Below are the results for the psychological distress measure (the K6) and mental health knowledge. The mental health knowledge questionnaire is also presented below.

|  |  |  |
| --- | --- | --- |
|  | **K6** | **K6 (inc. gender)** |
| *Predictors* | *Estimates* | *CI* | *p* | *Cohen’s d* | *Estimates* | *CI* | *p* | *Cohen’s d* |
| Intercept | 6.06 | 5.63 – 6.49 | **<0.001** | - | 6.63 | 6.14 – 7.12 | **<0.001** | - |
| Post-intervention | -0.05 | -0.37 – 0.27 | 0.757 | -.01 | -0.04 | -0.37 – 0.28 | 0.788 | -.01 |
| 6 months | -0.52 | -0.84 – -0.20 | **0.002** | -.07 | -0.51 | -0.84 – -0.19 | **0.002** | -.06 |
| 12 months | -0.50 | -0.83 – -0.16 | **0.003** | -.06 | -0.50 | -0.83 – -0.16 | **0.003** | -.06 |
| 18 months | 0.01 | -0.33 – 0.36 | 0.937 | .001 | 0.01 | -0.33 – 0.36 | 0.939 | .001 |
| Condition (Mental Health) | -0.01 | -0.60 – 0.58 | 0.971 | -.01 | 0.11 | -0.53 – 0.76 | 0.728 | .10 |
| Gender (Male) | - | - | **-** | - | -1.67 | -2.05 – -1.29 | **<0.001** | -.43 |
| Post-intervention x Condition (Mental Health) | -0.14 | -0.59 – 0.31 | 0.539 | -.03 | -0.15 | -0.59 – 0.30 | 0.520 | -.01 |
| 6 months x Condition (Mental Health) | 0.27 | -0.18 – 0.73 | 0.241 | .02 | 0.26 | -0.20 – 0.71 | 0.266 | .02 |
| 12 months x Condition (Mental Health) | 0.25 | -0.21 – 0.72 | 0.289 | .02 | 0.24 | -0.22 – 0.71 | 0.305 | .02 |
| 18 months x Condition (Mental Health) | 0.50 | 0.02 – 0.98 | **0.040** | .04 | 0.49 | 0.01 – 0.97 | **0.043** | .04 |
| **Random Effects** |
| σ2 | 16.34 | 16.34 |
| τ00 Student ID: School | 17.27  | 16.76  |
| τ00 School | 0.37  | 0.53  |
| ICC | 0.52 | 0.51 |
| N Student ID | 3321  | 3321 |
| N School | 39 | 39 |
| Observations | 12252 | 12252 |
| Marginal R2 / Conditional R2 | 0.002 / 0.520 | 0.020 / 0.524 |
| **Table S13**: Model estimates for psychological distress (K6), and when controlling for gender. σ2 represents the residual variance, unexplained by the predictors in the model. τ00 represents the between subject variance. |

***Psychological distress.*** Omnibus tests revealed no statistically significant time by condition interaction (*F*=(4, 9254.7)=2.12, *p*=.08) or main effect of condition (*F*=(1, 33.3)=.38, *p*=.54). There was a statistically significant main effect of time (*F*=(4, 9254.7)=9.57, *p*<.001). Model estimates are reported in table S13.

***Psychological distress, controlling for gender.*** Omnibus tests revealed no statistically significant time by condition interaction (*F*=(4, 9283.9)=2.08, *p*=.08) or main effect of condition (*F*=(1, 35)=.89, *p*=.35). There was a statistically significant main effect of time (*F*=(4, 9283.6)=9.52, *p*<.001) and gender *F*=(1, 1583.2)=73.33, *p*<.001). Model estimates are reported in table S13.

|  |  |  |
| --- | --- | --- |
|  | **Mental health knowledge** | **Mental health knowledge (inc. gender)** |
| *Predictors* | *Estimates* | *CI* | *p* | *Cohen’s d* | *Estimates* | *CI* | *p* | *Cohen’s d* |
| Intercept | 7.23 | 6.70 – 7.76 | **<0.001** | - | 6.07 | 5.61 – 6.53 | **<0.001** | - |
| Post-intervention | 0.58 | 0.42 – 0.74 | **<0.001** | .16 | 0.59 | 0.43 – 0.74 | **<0.001** | .16 |
| 6 months | 0.40 | 0.23 – 0.57 | **<0.001** | .10 | 0.40 | 0.23 – 0.57 | **<0.001** | .10 |
| 12 months | 0.52 | 0.35 – 0.68 | **<0.001** | .14 | 0.52 | 0.36 – 0.68 | **<0.001** | .14 |
| 18 months | 0.66 | 0.49 – 0.82 | **<0.001** | .17 | 0.66 | 0.50 – 0.83 | **<0.001** | .17 |
| Condition (Mental Health) | -0.07 | -0.81 – 0.68 | 0.859 | -.06 | 0.05 | -0.56 – 0.66 | 0.882 | .05 |
| Gender (Female) | - | - | **-** | - | 1.79 | 1.56 – 2.02 | **<0.001** | .57 |
| Post-intervention x Condition (Mental Health) | 0.94 | 0.72 – 1.16 | **<0.001** | .18 | 0.94 | 0.72 – 1.16 | **<0.001** | .18 |
| 6 months x Condition (Mental Health) | 0.46 | 0.21 – 0.71 | **<0.001** | .08 | 0.46 | 0.21 – 0.71 | **<0.001** | .08 |
| 12 months x Condition (Mental Health) | 0.46 | 0.24 – 0.69 | **<0.001** | .09 | 0.46 | 0.23 – 0.69 | **<0.001** | .09 |
| 18 months x Condition (Mental Health) | 0.35 | 0.11 – 0.58 | **0.004** | .06 | 0.34 | 0.11 – 0.58 | **0.004** | .06 |
| **Random Effects** |
| σ2 | 3.78 | 3.78 |
| τ00 Student ID: School | 5.80  | 5.33  |
| τ00 School | 1.19  | 0.76  |
| ICC | 0.65 | 0.62 |
| N Student ID | 3035 | 3035  |
| N School | 38 | 38 |
| Observations | 11224 | 11224 |
| Marginal R2 / Conditional R2 | 0.019 / 0.655 | 0.084 / 0.649 |
| **Table S14**: Model estimates for mental health knowledge, and when controlling for gender. σ2 represents the residual variance, unexplained by the predictors in the model. τ00 represents the between subject variance. |

***Mental health knowledge.*** Omnibus tests revealed a statistically significant time by condition interaction (*F*=(4, 8461.3)=18.23, *p*<.001) and a significant main effect of time (*F*=(4, 8461.3)=99.49, *p*<.001). There was no statistically significant main effect of condition (*F*=(1, 37.0)=1.01, *p*=.32). Model estimates are reported in table S14.

***Mental health knowledge, controlling for gender.*** Omnibus tests revealed a statistically significant time by condition interaction (*F*=(4, 8479.1)=18.24, *p*<.001) and a significant main effect of time (*F*=(4, 8479.1)=100.72, *p*<.001) and gender *F*=(1, 2922.6)=234.06, *p*<.001). There was no statistically significant main effect of condition (*F*=(1, 35.3)=2.55, *p*=.12). Model estimates are reported in table S14.

**Mental health knowledge questionnaire**

1 Which of the following is not a symptom of anxiety:

1. Dry mouth
2. Feeling sick
3. Sweating
4. Dizzy
5. Feeling sleepy

2 Realistic thinking helps you...

1. to worry more
2. to notice only the positive things in life
3. to identify and change unhelpful thoughts
4. to fix hallucinations
5. to ignore the negative aspects of life

3 Being assertive…

1. means being aggressive to get what you want
2. may be difficult at first, and requires practice
3. means backing down
4. is always easy
5. is childish, adults do not have to do this

4 When facing fears, it is best to...

1. confront your worst fear first
2. avoid the situations which make you fearful
3. face easier fears first
4. only face fears if they do not make you anxious
5. just hide away in a cupboard

5 When speaking up for yourself you should...

1. talk in a quiet voice so as not to make anyone angry
2. always put the needs of others first
3. start by accusing the other person of never listening
4. state clearly what you want and how you feel
5. just not try - no one will listen anyway

6 Fortune telling, mind reading, underestimating abilities and catastrophising are all types of:

1. Thinking traps we fall into when we are anxious or depressed
2. Things that help us to cope when we are anxious or depressed
3. Helpful ways of responding to stressful situations
4. Super powers
5. Bad habits

7 Structured problem solving is:

1. Letting other people solve your problems for you
2. Identifying a problem, working out the best solution and reviewing how it went
3. Unsuitable for people who are feeling anxious or depressed
4. Something only a psychologist can do
5. A cure for depression or anxiety

8 An example of a negative thinking habit that can affect how you feel is

1. “Nobody cares about me”
2. “I don't like the new teacher”
3. “The weekend is over so it’s back to school today”
4. “I refuse to do that”
5. “Two plus two equals five”

9 Thought challenging is

1. Winning an argument using logic
2. Thinking hard about a challenging maths problem
3. Something philosophers do
4. Acting on a good idea or thought
5. Looking at all the evidence before jumping to conclusions

10 When facing a problem that seems overwhelming you should

1. Write down step by step what the problem is and how it can be solved
2. Close your eyes and count to ten and think of a happy time in your life
3. Find out who caused the problem and blame them for it
4. Focus energy on other things because it will probably work out on its own
5. Cry and give up and not try again

11 Which of the following is NOT a symptom of depression?

1. Low energy
2. Self-criticism
3. Difficulty making decisions
4. Wanting to go out all the time
5. Not interested in usual activities

12 If Will is feeling too depressed to go out with friends he should

1. Try really hard to do the activities he used to enjoy, even if he doesn’t feel like doing them
2. Listen to how he's feeling and wait until he's in the right mood before going out
3. Spend the day in bed and get lots of rest
4. Think about all the things that are upsetting him
5. Tell his friends he's coming and see if they notice when he doesn’t turn up

13 If you're feeling down, pleasant event scheduling helps you to

1. Regularly do charitable things so people will think highly of you
2. Make sure you don’t miss out doing things like chores and homework
3. Limit the time spent on things you enjoy so they don't take up your whole day
4. Avoid things you don't like doing
5. Make sure you keep doing the things you enjoy

**Fidelity of the mental health intervention**

A sub-sample of the teachers from the mental health group (n=21) returned a fidelity logbook. Completion rates for each of the six lessons ranged from 88-97%.

Further data were gathered from the broader study, which included feedback from those who received the climate mental health standalone intervention (presented in the current study) and also the combined mental health and substance use study (Teesson et al., 2020). In order to establish levels of engagement a sample of students (n=762) and teachers (n=67) who received/delivered the Climate Schools Mental Health course provided feedback about the course. Overall, evaluation data from both students and teachers was very positive. The majority of students (60%) rated the course as good or very good overall and most (70%) thought that the skills and information they received in the program would help them deal more effectively with their problems in the future. Just under half (49%) indicated the stories were relevant to experiences in their lives however, only 29% would recommend the course to their friends. The majority of teachers (75%) indicated that the Climate Schools Mental Health course was better (or much better) than other school mental health education programs. The majority (68%) indicated that they were likely to recommend the program. Please see the supplementary material from Teesson et al., 2020 for further information.

**Implementation of additional mental health programs (Control group)**

Teachers were asked to provide details about the amount and format of any mental health education including information about anxiety and/or depression they delivered in the intervention years of 2014 and 2015. In 2014, just over half of teachers (51%) reported running a mental health education program. The number of lessons varied between schools (ranging from one to 10), and the average length of each lesson spent on mental health education was 50 minutes. The majority of teachers (81%) reported using a combination of face-to-face and computer-based methods to teach mental health education topics. The main content areas covered by control schools in 2014 were: coping skills, resilience, mental health literacy and self-esteem. Two schools reported providing some form of mental health education to parents of the study cohort. In 2015, 54% of teachers reported running a mental health education program. The number of lessons varied between schools (ranging from two to 20), and the average length of each lesson spent on mental health education was 52 minutes. The majority (71%) reported using a combination of face-to-face and computer-based methods to teach mental health education topics. The main content areas covered by control schools in 2015 were: coping skills, recognising signs and symptoms of mental health problems and emotional regulation. No schools provided mental health education to parents of the study cohort in 2015.