

Supplementary material

Assessing training effects using ANCOVA analysis

As outlined in the results section, one-way ANCOVAs with baseline performance as a covariate were also completed to explore training effects. ANCOVAs were completed for each task in the test battery. Training mode (2 levels: explicit, implicit) and training type (3 levels: mental rotation, spatial scaling, literacy) were included as between participant variables. Post-training scores (Time 2) were included as the dependent variable and pre-training scores (Time 1) were included as a covariate.

Consistent with the MANOVA results reported in the main manuscript, there was a main effect of training type for: the Mental Rotation Task, $F(2,236) = 4.96, p = .008, \eta_p^2 = .040$; the Spatial Scaling task, $F(2,231) = 12.09, p < .001, \eta_p^2 = .094$; Missing Term Problems, $F(2, 208) = 3.85, p = .023, \eta_p^2 = .036$; PAE scores on the Number Line Estimation Task, $F(2,236) = 7.29, p = .001, \eta_p^2 = .058$, and; Geometry Shape Items, $F(1,218) = 4.91, p = .008, \eta_p^2 = .043$. Consistent with the results reported in the main manuscript, there was no main effect of training type for Geometry Symmetry Items, $F(2,212) = 0.55, p = .877, \eta_p^2 = .005$.

To further explore the main effects of training type, bonferroni comparisons were used to compare performance at Time 2 across training types. For the Mental Rotation Task, pairwise comparisons demonstrated that those who completed mental rotation training had significantly higher scores at Time 2 than those who completed control training ($p = .006$). The mental rotation training group also had higher scores than those who completed spatial scaling training, although this difference was not significant ($p = .305$). There was no significant difference in performance between those who completed spatial scaling and control training ($p = .397$). For the Spatial Scaling Task, pairwise comparisons indicated that performance at Time 2 was significantly higher for those who completed spatial scaling training compared to those who completed mental rotation training ($p < .001$) or control training ($p < .001$). There was no significant difference in performance between those who completed mental rotation and control training ($p = 1.00$).

For Missing Term Problems, pairwise comparisons indicated that those who completed mental rotation training had higher performance scores than those who completed spatial

scaling training ($p = .032$) or control training ($p = .085$). There was no significant difference in performance between those who completed spatial scaling and control training ($p = 1.00$). For PAE scores on the Number Line Estimation Task, error scores were significantly lower after spatial scaling training compared to mental rotation training ($p = .036$) and control training ($p < .001$). Error scores were lower, although not significantly, for the mental rotation training group compared to the control training group ($p = .085$). Finally, for the Geometry Shape Items, performance was significantly higher following both mental rotation training ($p = .024$) and spatial scaling training ($p = .019$) compared to control training. There was no significant difference in performance between the mental rotation and spatial scaling training groups ($p = 1.00$)

For training mode, there was a significant main effect for Geometry Shape Items, $F(2,212) = 0.55$, $p = .877$, $\eta_p^2 = .005$. This favoured implicit instruction. No other main effects of training mode were found for: the Mental Rotation Task, $F(1,236) = 0.01$, $p = .969$, $\eta_p^2 = .001$; the Spatial Scaling task, $F(1,231) = 2.28$, $p = .133$, $\eta_p^2 = .010$; Missing Term Problems, $F(1, 208) = 2.43$, $p = .120$, $\eta_p^2 = .012$, Geometry Symmetry Items, $F(2,212) = 0.15$, $p = .701$, $\eta_p^2 = .001$, and; PAE scores on the Number Line Estimation Task, $F(1,236) = 2.99$, $p = .085$, $\eta_p^2 = .013$. There were no significant interactions between training type and training mode for any task (p 's $> .391$; η_p^2 's $< .008$).