Recently, there has been much interest the effectiveness of cognitive training programmes across a variety of cognitive and perceptual domains. Some evidence suggests that combining training programmes with noninvasive brain stimulation techniques such as transcranial random noise stimulation (tRNS) can enhance training gains, but to date this has only been examined in numerosity and arithmetic tasks. In this study, we examined whether tRNS modulated the effects of a face recognition training programme. Participants completed a face discrimination training task for an hour per day over five days. Each day, training was preceded by twenty minutes of active high frequency tRNS or sham stimulation, targeted at the posterior temporal cortices or the inferior frontal gyri (IFG). Participants who received active stimulation to the posterior temporal cortices showed significant improvement on a facial identity discrimination task (the Cambridge Face Perception Test) after training, whereas those receiving sham or IFG stimulation showed no performance change. There was no evidence of an effect of stimulation on a face memory task (the Cambridge Face Memory Test). These results suggest that tRNS can enhance the effectiveness of cognitive training programmes, but further work is needed to establish whether perceptual gains can be generalised to face memory.