

Vas AK, Chapman SB et al. Higher-Order Reasoning Training Years After Traumatic Brain Injury in Adults. J Head Trauma Rehabil 2011;26(3):224-239.

Design: Randomized clinical trial

Population/sample size/setting:

- 28 community-dwelling adults (16 men, 12 women, mean age 43) with chronic TBI treated at the Center for Brain Health at the University of Texas at Dallas
- Eligible participants were native English speakers with TBI at least one year earlier, with moderate functional impairments on the Glasgow Outcome Scale Extended (GOS-E) and on the Functional Status Examination (FSE), with at least a high school education
- Exclusion criteria were pre-TBI history of stroke, learning disability, communication disorder, substance abuse, or major psychiatric disorder; participants with current depression or receiving cognitive treatments were also ineligible

Main outcome measures:

- Majority (23 of 28) of participants had had TBI more than 15 years prior to entry, with limited information on severity of TBI; 6 had evidence of “severe” TBI and 2 had documented “mild” injury; the mean years of education were 15.7 (range 12-18)
- Randomized to one of two cognitive rehabilitation programs: Strategic Memory And Reasoning Training (SMART) and Brain Health Workshop (BHW)
 - o SMART is a strategy-based training program based on the theoretical construct of “gist-reasoning” relevant to everyday life tasks
 - o Gist-reasoning is a construct which emphasizes the ability to derive global meaning from specific details, rather than verbatim memory; this is based on evidence that gist and verbatim functions are independent, and that gist meaning is more robustly stored and retrieved compared to verbatim memory
 - o Gist is measured by administering a test in which participants are asked to summarize the meaning of three texts from 291 to 575 words in length; the text is read aloud by an examiner as the participant follows along on paper; the paper is then taken away and the participant’s summary is scored for how well it presents the principal ideas of the text (rather than a recitation of details)
 - o BHW is an information-based program, with Power Point presentations covering brain anatomy and function, with information concerning the effect of sleep, diet, and other lifestyle variables on brain function
- Both SMART and BHW offered 18 hours of training in 12 sessions of 1.5 hours each over a period of 8 weeks; participants were in small groups (4 or 5) led by a speech pathologist and an occupational therapist with TBI experience

- SMART program presented 5 basic strategies directed at three cognitive control processes fundamental to gist reasoning: strategic attention (inhibiting less relevant information), integrated reasoning (combining previous knowledge with relevant new information), and innovation (flexibly interpreting information from different perspectives)
- BHW program offered group discussions and reading material to accompany each didactic presentation, covering the functions of each lobe of the brain, effects of TBI on brain functions neuroplasticity, and techniques to measure brain function (neuropsychological testing, imaging such as fMRI/PET)
- Primary outcomes were compared at the end of the 8 week training period and again at 6 months after training
 - SMART group had improvements of approximately one third on measures of gist between baseline and 8 weeks; these improvements were maintained at 6 months
 - BHW group had no significant improvements in measures of gist either at 8 weeks or at 6 months
 - The SMART group, but not the BHW group, improved on tests of working memory between baseline and 8 weeks; these improvements were also maintained at 6 months
 - Two self-report outcomes were the Community Integration Questionnaire-Composite Score (CIG-CS) and the CIG for social integration (CIG-SI); although the SMART and BHW groups were similar at baseline and at 8 weeks, the SMART group had higher scores on both the CIG-CS and the CIG-SI at the 6 month follow-up
 - The assessments of gist and of working memory were done by examiners blinded to group assignment
- Although return to work was not reported, 19 of the participants were either gainfully employed or performing volunteer work at the start of the study; the remaining 9 were living in the community but not involved in work activities

Authors' conclusions:

- "Gist reasoning" is an ecologically valid construct for characterizing abstraction skills through strategic attention, integration, and cognitive innovation
- The SMART program, using 18 hours of group instruction, enhanced gist reasoning in adults with TBI, and generalized to domains which were not included in the training, such as working memory and increased participation in social activities
- Whereas many therapeutic approaches apply strategies to solve or accomplish a preset goal or a predetermined problem, SMART participants were taught to apply strategies across domains during training sessions
- Several limitations apply to the study and its results

- The participants were recruited from the community many years after TBI, and reliable documentation about the severity of the acute TBI was not available
- The study included wide age ranges, including some participants who had sustained TBI during preteen years, when frontal network myelination is still taking place; if there is an influence of age on the benefits of SMART, this will have to await further study
- The functional gains depended on self-report questionnaires which could represent participant perception of gains made after training

Comments:

- While there are several problems involved in the interpretation and application of the study results, not all of the problems undermine the results
 - The long interval between TBI and entry into the program would not be expected to create biases which would inflate the therapeutic effects of the intervention, given that it is generally assumed that there is a window of opportunity early after TBI in which improvements are most likely to be expected
 - If many of the participants sustained TBI during the preteen years while frontal lobe maturation is incomplete, this would also be expected not to inflate the benefits of training
 - The lack of data on severity of TBI is unfortunate, but this would tend to obscure the effects of an intervention if severity is an important predictor of response to treatment
- The primary outcomes in Table 4 may have been selected from a fairly number of measured variables, and their a priori selection cannot be assumed
 - 2 measures of working memory were done, but only 1 was reported; a test of inhibition was done but not reported; nonverbal reasoning, cognitive flexibility, and verbal fluency were among the variables measured, but were not reported in Table 4
 - The significance levels for the ANOVA in Table 4 were said to be Bonferroni adjusted for multiple comparisons but this is not clear from the final column (e.g., the unadjusted p value for an F statistic with 2 and 48 degrees of freedom is 0.0332, which is the same as the 0.03 reported for the gist variable)
 - Under “interaction effects” on page 232, the differences between baseline and post-training for detecting abstracted meanings from the test texts is reported for the SMART group but not for the BHW group
 - Since the study design appears not to have been in a registry such as clinicaltrials.gov, there is no way to compare a study protocol for the analysis of data with the way the data were analyzed and reported
- It is difficult to compare different studies of cognitive rehabilitation in TBI, since they are based not only on different interventions, but also on different theoretical frameworks for deciding what is wrong and what needs to be remedied

- The SMART program is being compared with another cognitive intervention, not with “usual care” or a wait list; this is likely to underestimate its effectiveness compared with doing nothing
- On balance, the problems threatening to inflate the effectiveness of the SMART program are offset by problems which would threaten to reduce the estimate of its effectiveness
- The cost of a program of 18 hours of instruction in executive function skills is not likely to be prohibitive

Assessment: Adequate for evidence that a cognitive program aimed at gist instruction is likely to improve some aspects of executive function

References:

Anand R, Chapman SB et al. Gist reasoning training in cognitively normal seniors. *Int J Geriatr Psychiatry* 2011; 26: 961–968.

Lloyd L, Reyna VF. Clinical Gist and Medical Education: Connecting the Dots. *JAMA* 2009;302(12):1332-1333.

Reyna VF. A Theory of Medical Decision Making and Health: Fuzzy Trace Theory. *Med Decis Making*. 2008 ; 28(6): 850–865.