Teamwork Exercises and Technological Problem Solving with
First-Year Engineering Students: An Experimental Study

by

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ABSTRACT

An experiment was conducted investigating the utility of *teamwork exercises* and *problem structure* for promoting technological problem solving in a student team context. The *teamwork exercises* were designed for participants to experience a high level of psychomotor coordination and cooperation with their teammates. The *problem structure* treatment was designed based on small group research findings on brainstorming, information processing, and problem formulation. First-year college engineering students ($N = 294$) were randomly assigned to three levels of *team size* (2, 3, or 4 members) and two treatment conditions: *teamwork exercises* and *problem structure* ($N = 99$ teams). In addition, the study included three non-manipulated, independent variables: team gender, team temperament, and team teamwork orientation. Teams were measured on technological problem solving through two conceptually related technological tasks or engineering design activities: a *computer bridge* task and a *truss model* task. The *computer bridge* score and the number of computer bridge design *iterations*, both within subjects factors (*time*), were recorded in pairs over four 30-minute intervals. For the last two intervals with the computer bridge, teams started construction of the truss model task, which created *low* and *high task load* conditions for the computer bridge: another within subjects factor.

A repeated measures ANOVA was used to analyze *time* (*computer bridge*) by factor interactions. No significant *time* by *teamwork exercises* or *time* by *problem structure* interactions on *computer bridge* scores were found [$F(2.31, 198.46) = 0.10$, $p = .928$; $F(2.31, 198.46) = 0.03$,

$p = .984$]. There was a significant interaction between the factors of *time* and *team size* [$F(4.62, 198.46) = 2.75$, $p = .023$]. An ANOVA was conducted with the between subject factors on the *truss model* task. A significant main effect was found for *teamwork exercises* [$F(1, 86) = 2.84$, $p = .048$, one-tailed], but not for *problem structure* or *team size*. Post hoc analyses were conducted for *team size* on *computer bridge* and *iteration* scores over time, as well as *teamwork exercises* effects for each *team size*. Findings and their implications were reported, along with suggestions for future research on technological problem solving in a team context.