A Theory of Cooperative Learning as Incentive-Values–Exchange: Studies of the Effects of Task-Structures, Rewards and Ability on Academic and Social-Emotional Measures of Mathematics Learning

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DECLARATION

I declare that this thesis is my own account of my research and contains as its main content work, which has not previously been submitted for a degree at any tertiary institution.

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ABSTRACT

This PhD thesis is concerned with the social psychology of cooperative learning and its effects in cognitive and social-emotional domains. It comprises two main studies and two exploratory studies undertaken during two 10-day, 16-hour learning intervention programmes for Maths Word Problem-Solving (MWPS), respectively for 285 and 451 Grade-5 students in Singapore.

Study 1 used a quasi-experimental design to investigate the outcomes of task-structures in an Individual Learning condition and three dyadic Cooperative Learning conditions that varied in the key elements: positive interdependence, individual accountability and group goals. The results indicated that a Cooperative Learning condition with a high level of positive interdependence in combination with a low level of individual accountability resulted in significantly lower MWPS academic achievement and peer–self-concept outcomes than the other conditions; whereas the other Cooperative conditions with lower levels of positive interdependence did not differ significantly from the Individual Learning condition in MWPS academic outcomes but produced better peer–self-concept outcomes. The discussion theorises how task-structured positive interdependence in cooperative conditions can potentially be so rigid that it limits individual control in overcoming a dyadic partner's error. In turn, this increases the likelihood that members of dyads would "sink together" (rather than "swim together") –which appears to produce relatively worse MWPS academic outcomes as well as being detrimental to peer–self-concept outcomes. Therefore, optimal cooperative learning conditions for mathematics should allow interaction amongst student partners but not preclude individual control over any stage of the learning task.

Study 2 comprised three interrelated investigations of the effects of rewarding learning behaviours and the effects of ability-structures on Individual, Equals (homogeneous) and Mixed (heterogeneous) dyads. All children were eligible to be rewarded for their own MWPS academic mastery achievements, but comparison groups in each of the ability-structures were either eligible or not eligible to be rewarded for displaying target learning behaviours (LB-Rewards or No-LB-Rewards). The academic programme was based on Polya's problem-solving strategies of understanding the problem, devising a plan, carrying out the plan, and checking the results. Children in all learning conditions were instructed to use these problem-solving strategies and, according to their differently assigned learning conditions, to use learning behaviours (LB's) either '*for helping oneself*' in Individual conditions or *'helping one's partner'* in Equals and Mixed conditions. In "LB-Rewards" conditions, teachers rewarded the children's displays of the assigned behaviours for learning alone or learning together, whereas in "LB-No-Rewards" conditions they did not.

The investigation in Study 2a encompassed the same dependent variables as Study 1. The results indicated that for maths (MWPS), Learning Behaviour rewards were detrimental to Individual Learning conditions with significantly lower MWPS gains when the rewards were used compared to when they were not, whereas the opposite pattern was found for Equals where the effects of Learning Behaviour significantly enhanced MWPS outcomes. For peer–self-concept, effects varied across the Cooperative conditions' Learning Behaviour rewards conditions. An exploratory analysis of High-, Low- and Medium-ability revealed patterns of the inter-relationships between ability-structures and effects of rewarding.

Study 2b is exploratory and involved traversing the traditional theoretical dichotomy of individual vs social learning, to develop a measure combining them both in 'self-efficacy for learning maths together and learning maths alone'. The effects of

the various experimental conditions on factors in this measure were explored, allowing detailed insight into the complex, multi-dimensional and dynamic inter-relationships amongst all the variables. The findings have been developed into a theory of Incentive-values–Exchange in Individual- and Cooperative-learning, arguing that there are four main cooperative learning dimensions – "individual cognitive endeavour", "companionate positive influence", "individualistic attitudes development" and "social-emotional endeavour". The argument is that students' motivation to learn cooperatively is the product of perceived equalization of reward-outcomes in relation to each dyadic member's contributions to learning-goals on these dimensions. Hence, motivation varies across ability-structures and reward-structures in a complex manner. A further proposition of the theory is that social-emotional tendencies and biases form a dynamic system that tends to maintain dyadic partners' achievement levels relative to their ability-positioning.

Study 2c is exploratory and extends Study 2b by illustrating its Incentive-values–Exchange theory. Samples of children's written descriptive reflections of their experiences in cooperative dyads are provided to illustrate the point made about the children's relationships and effects on each other for each of the factors on the individual- and cooperative-learning scales. As such, this section of the thesis offers a parsimonious explanation of cooperative learning and the effects of various learning conditions on the integrated cognitive, social and emotional domains.

Practical implications in light of the study's findings of optimal conditions include the possibility of practitioners more closely tailoring cooperative learning conditions to meet the academic or social-emotional needs of learners at specific ability levels. Future directions for research include testing some of the learning dimensions and proposed theoretical configurations for them using controls identified by the statistical analyses together with qualitative observations, and further developing new

methodologies for investigating the social-psychological causes and consequences of learning motivation.

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CTEHP = Committee on Techniques for the Enhancement of Human Performance

D = Dimension[1]

Fem = Female

H = High-ability

IA = Individual Accountability

IAc = Individual Accountability Control

Jigsaw-DT = Jigsaw-(Dyadic–Task-structure)

L = Low-ability

LB-Rewards = Learning Behaviour Rewards

M = Medium-ability

MWPS = Maths Word Problem Solving

PI = Positive Interdependence

SDQ = Self Description Questionnaire

SDQ-I Peer = Self Description Questionnaire for Peer–Self-concept

SDQ-I Maths = Self Description Questionnaire for Maths–Self-concept

SLQ = Student Learning Questionnaire

SLQ-Individual = Student Learning Questionnaire, Individual Learning section

SLQ-Cooperative = Student Learning Questionnaire, Cooperative Learning section

SLQ-Alone-&-Partnered = Student Learning Questionnaire, both parts

[1] This acronym for 'Dimension" is only used in the index, indexed results of Study 2b's "Exploratory propositions", and as a cross reference in Study 2c.

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