

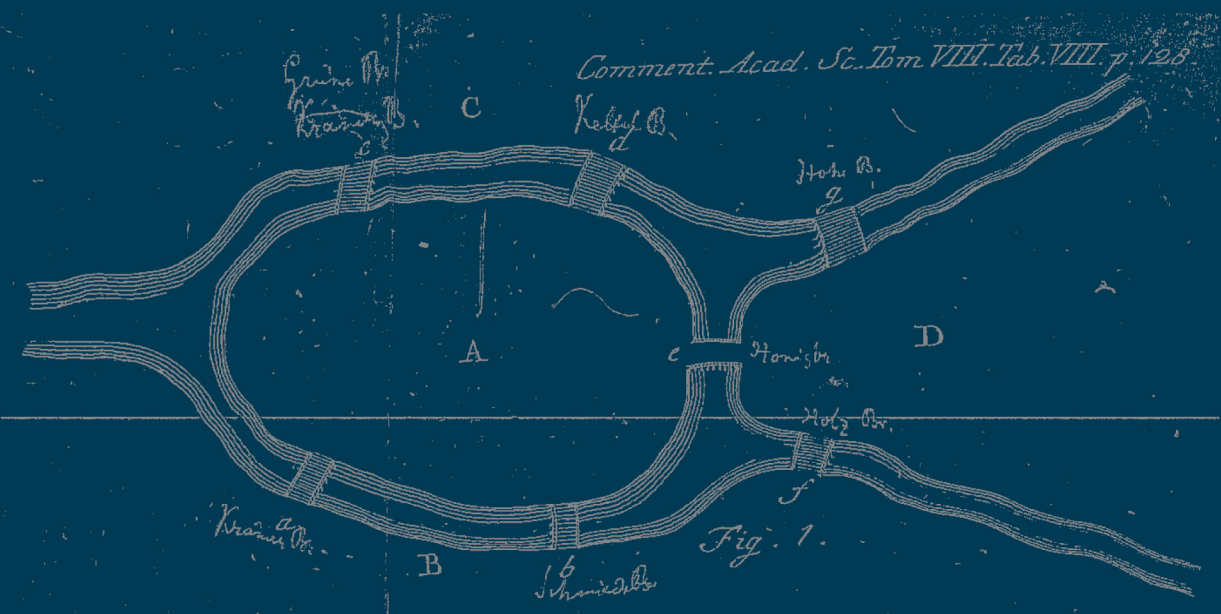
INTERNATIONAL STUDIES IN TIME PERSPECTIVE

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CHAPTER 23

THE EFFECT OF COMBINED MASTERY-COOPERATIVE LEARNING ON WORKING MEMORY CAPACITY, SELF-EFFICACY AND ACADEMIC ACHIEVEMENT IN GRADE SKIPPING

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ABSTRACT: In this study 25 students of one of the volunteer middle schools of Tehran who were eligible to take grade skipping test were randomly selected and were then examined with working memory capacity test and self-efficacy questionnaire. Then, they participate in a 45-day teaching program for 11 hours a day in summer. The same test and questionnaire given prior to the educational program were re-administered, after the students had completed the educational program and then taken the grade skipping test. These same both tests were administered for a third time, one year later. To examine academic achievement, in the pre-test, the grade point average (GPA) of the first year of the middle school, in the post-test the GPA of the grade skipping exam and in the follow-up the GPA of the third grade of the middle school were taken into account. The repeated measures ANOVA showed a significant increase in working memory capacity and its components, storage and processing, and self-efficacy.

Keywords: cooperative-mastery learning, working memory capacity, self-efficacy, academic achievement.

INTRODUCTION

Acceleration is an educational intervention based on progress through an educational program at rates faster or at ages younger than typical (Pressey, 1949). It is ideally suited to academically gifted students — young people who have an enhanced capacity to learn. Acceleration practices provide the appropriate level of challenge and reduce the time necessary for students to complete traditional schooling (NAGC, Position Paper, 1992, cited in Colangelo et al., 2004). There are many forms of acceleration, over than 18 types, that one of them is Grade-skipping or whole-grade acceleration (Colangelo et al., 2004).

Study and research in this field showed that grade skipping for students who are ready, and for whom the process has been carefully considered, can be not only an effective and sound intervention, but better than the alternative, i.e., doing nothing (Colangelo et al., 2004).

In current study, we use a special instruction, combined mastery-cooperative learning, for this mean.

The cooperative learning is one of the educational methods that have attracted the attention of many authors and the relevant studies illustrate its capacity to enhance the access of the students to considerable educational and social progress (Johnson & Johnson, 2002). Cooperative learning consists in a working group of students aiming to achieve one mutual goal using cooperative skills and face-to-face progress feedback (Johnson, Johnson & Smith, 1991). In fact, according to some authors it is a process that maximizes the students learning (Johnson et al., 1999).

The extant research showed that cooperative learning has a positive effect on several relevant constructs, such as: educational progress, academic success, long term memories, critical thinking, cognition, higher level reasoning, friendship communications, self-esteem, self-respect, attitude, anxiety and control (Johnson & Johnson, 1989; Artut, 2009; Edrem, 2009).

Some psychologists and trainers believe that learning should be organized in such manner that each student can act and learn to have more academic achievement on the basis of their abilities. In this regard the mastery learning method is suitable. As Gentile (1994; cited in Damavandi et al., 2010) said, mastery learning method includes two systems which derived from different theories but have common learning goals and standards. The first is Keller Personalized System of Instruction that is an individual method in which some large groups are taught. Basis of this system is that development and progress depend on success of the students in doing their homework in the curriculum. The second is the Mastery for Learning Group-Based Approach which was presented in the Carroll learning model (1968; cited in Damavandi et al., 2010) and says that classroom learning is a time-based phenomenon and the longer time of learning lead to the higher rate of learning. This method in comparison with the traditional training, in the different science courses such as physics (Wambugu & Chageiywo, 2008), chemistry (Damavandi et al., 2010), mathematics (Shafie, et al., 2010) has been more successful. The researches have shown that combination of these two methods have completed each other and have more effects on the academic achievements (Baker et al., 1989; Mevareach, 1986) and mental abilities (Krank & Moon, 2001). There are common aspects between cooperating and mastery learning. For instance, evaluation of students and giving scores to them is based on their learning issues and practical abilities, instead of comparing rate of one student with his class mates. Other similarities are flexibility in performing and adaptability with teachers' methods in teaching and class atmosphere (Guskey, 1987).

Working memory is a mental workspace that is responsible for temporary storage and processing of information for performing a range of complicated cognitive tasks such as understanding, reasoning and learning (Daneman et al., 1980). Many researchers have shown that individuals with high working memory capacity exhibit better learning performance because they have more cognitive sources (Daneman et al., 1980; Mossavi et al., 1995).

One of the most effective psychological factors on the academic achievement of students is self-efficacy, a concept that originates on the Bandura's theory of social learning, and consists of self-judgments about the person's capabilities to perform well in specific situations and tasks (Bandura, 1982). Self-efficacy affects goals, levels of motivation, academic achievement and student's attuned believes in learning and access to higher level

studies (Shunck, 2010). Many researchers showed the direct and positive relationships between self-efficacy and academic achievement (e.g. Bandura et al., 1996; Greene et al., 2004; Sharma, 2007; Carroll, 2009).

This study examined the effect of combined mastery-cooperative learning on academic achievement via the effect on working memory capacity and self-efficacy in grade skipping.

METHOD

Initially from a candidate school in Tehran 25 samples who were eligible to take a grade skipping test [least grade point average (GPA) 18 and least score 15] were randomly selected from female first year students. In the pre-test, the Working Memory Test of Daneman & Carpenter (1980) and the self-efficacy scale of Sherer (1982) were administered to the sample. After that, training sessions have been carried out during 45 continuous days and for several hours each day in summer. The questionnaires were re-administered, after the students had completed the educational program and then taken the grade skipping test. The same tests were administered for a third time, one year later. To examine academic achievement, the GPA of the first year of the middle school, the GPA of the grade skipping exam, and the GPA of the third grade of the middle school were taken into account. Data were analyzed by one way ANOVA analysis with repeated measure ($p < 0.05$).

Working memory test of Daniman & karpenter (1980)

This test has a series of dual-tasks which required simultaneous processing and storage of information. The processing task for reading–span is to read a series of sentences, while the memory task is to recall the last word in each sentence. The correlation of this test with a verbal aptitude test is 0.59, with a special comprehensive test is 0.72, and with indicate pronouns test is 0.90 (Daniman & Karpenter, 1980). Reliability coefficient was 0.88, in one pilot study that have been done on eighty four students (Asadzadeh, 2004).

Sherer et al. self-efficacy scale (GSE, 1982)

This test has 23 items of which 17 items evaluate general self-efficacy. The responses are made according to a Likert-type scale (from absolutely agree to absolutely disagree). The general score of this questionnaire correlates with several other measures, such as scores of internal locus of control, internal competence, self-esteem, and assertiveness. In terms of reliability (internal consistency) a Cronbach alpha 0.80 was achieved.

RESULTS

According to Table 1, scores of working memory capacity, storage, processing, and self-efficacy have increased.

Table 1 – Descriptive statistics for variables

Variables	Pre-test		Post-test		Follow up	
	Mean	Sd	Mean	Sd	Mean	Sd
Working memory capacity	104.42	21.57	123.52	16.50	121.87	18.93
Storage	44.60	12.20	53.32	9.20	53.58	7.60
Processing	59.83	14.57	70.20	11.88	68.30	16.60
Self-efficacy	55.88	10.17	66.08	6.52	66.72	6.33
Academic achievement	19.12	0.70	19.00	0.54	18.94	0.90

Note. Sd. = Standard deviation

Table 2 – One way Analysis of variance with repeated measure for variables

Effect	Value	F(2,23)	P <	Effect size
Working memory capacity	0.441	14.55	0.001	0.559
Storage	0.558	9.12	0.001	0.442
Processing	0.527	10.31	0.001	0.473
Self-efficacy	0.248	38.82	0.001	0.752
Academic achievement	0.793	4.73	0.070	0.207

Note. F values gained by Wilks' Lambda.

Table 3 – Means comparison

Variables	Md	P <	Md (2,3)	P <	Md (1,3)	P <
Working memory capacity	19.10	0.001	1.65	1.00	17.45	0.001
Storage	8.73	0.002	0.26	1.00	8.99	0.001
Processing	10.37	0.001	1.91	0.80	8.46	0.030
Self-efficacy	10.20	0.001	0.64	0.505	10.84	0.001
Academic achievement	0.36	0.317	0.04	1.00	0.18	0.150

Note. Md = Deferential mean, 1 = pre-test, 2 = post-test, 3 = follow up.

As it is observed in Table 2, statistically significant differences ($p < 0.05$) were obtained for the majority of the observed variables, namely working memory and its components (storage and processing) and self-efficacy. The means show that this significant difference has resulted from increasing post-test scores of these variables. Effect sizes of working memory, storage, processing, and self-efficacy are 0.559, 0.442, 0.473, and 0.752, respectively. In accordance with the Cohen's guidelines (1988) that introduce small effect size of 0.01, medium effect size of 0.06 and large effect size of 0.14, the above-mentioned effect sizes are large and show major impact of training on the variables.

As it is clear in Table 3, differences between the means of pre-test and post-test in test working memory capacity and its components (Storage and Processing) and self-efficacy are significant. The results show that in the post-test, the means of these variables have increased (cf. with Table 1 figures). The differences between means (post-test and follow up) aren't significant for any of the measured variables, which shows stability of results after one year.

DISCUSSION & CONCLUSION

The aim of this study was to investigate the effect of combined mastery-cooperative learning on working memory capacity, self-efficacy and academic achievement in grade skipping from first grade to third grade of middle school. From our data it is clear that test working memory capacity and its components (storage and processing), and self-efficacy have significantly increased with the training provided to the student's. Significant change has not been reached in academic achievement during the time allotted to the study. This issue does not mean that this method has no impact on this variable; probably the stress and strain that accompanies the move to a upper academic grade (with a concomitant hardness of study lessons compounded by higher levels of mental problems, such as anxiety due to changing in current situation), has been accompanied by an educational drop.

One of outcomes of current study is the positive effect of this method on working memory capacity that occurs by enhancing the amount of information storage and the improved quality of the students information processing. Many researchers on instruction found that mastery and cooperative learning positively affect memory and not only increase space of memory by omitting unrelated information and dysfunctional behaviors and emotions such as individual competition, anxiety, etc. (Guskey, 1987; Gillies & Ashman, 1998; Johnson & Johnson, 2002; Gillies, 2003; Shellhase, 2008) but also improve processing of information related to task in hand and by this way increase working memory capacity.

These results about direct effect of this method on academic achievement are consistent with previously published research by Baker, King and Wulf (1989), Mevareach (1986a, b) and Krank and Moon (2001).

It seems that one of the factors associated with the promotion of academic progress can be working memory capacity enhancement that occurs via the increment of storage and processing capabilities. This result is similar to the other research studies that showed that an increase in working memory capacity leads to achievement in many courses and causes academic achievement. Accordingly, our findings are in line with findings of Grimley et al. (2008), Alloway and Alloway (2010), Raghubar et al. (2010), Daneman & Carpenter (1986) and Mossavi et al. (1995).

Furthermore, improvement of self-efficacy in students is another factor that can lead to academic achievement. This assumption is based on studies that revealed that when self-efficacy of students is increased academic achievement is also increased. In line with this result we can mention the studies carried out by Bandura et al. (1996), Chemers et al. (2001), Valentine et al. (2004) and Carroll et al. (2009).

The present research is innovative and relevant for several reasons. At an individual level it can be exciting for some students who seem to be future oriented and feel compe-

tent, to be able to more rapidly progress in their educational path. It can be important to the families also because skipping a grade (or more) leads to a reduction in the duration of training and of all associated tuition costs. Finally for society, mainly in poor provinces (and countries) it can be used to optimize the existing resources, especially by promoting motivation and cognitive skills that have a strong and positive impact in the students learning progress.

For the proper generalization of these results this research should be replicated with other students attending other schools and also other grades and educational levels.

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