

Comparing the effect of computer-assisted collaborative and individual concept mapping on improving critical thinking ability: The role of student learning style

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Abstract—This paper compared the effect of computer-assisted collaborative concept mapping and computer-assisted individual concept mapping on improving students' critical thinking ability under different learning styles. The experimental results showed that the effect of computer-assisted collaborative and individual concept mapping on improving statistics critical thinking ability is not significantly different. However, when considering student learning style, experimental results showed that comparing to computer-assisted individual concept mapping, computer-assisted collaborative concept mapping provides better assistance to improve statistics critical thinking ability for students who have accommodating and diverging learning styles. Conversely, for students who have assimilating and converging learning styles, the computer-assisted individual concept mapping offers better benefit to improving their statistics critical thinking ability than the computer-assisted collaborative concept mapping. Implications for research and practice are discussed.

Keywords—computer-assisted collaborative concept mapping, computer-assisted individual concept mapping, critical thinking ability, learning style

I. Introduction

Past studies compared the effect of individual and collaborative concept mapping strategies on learning. However, their results were inconsistent. The reasons of inconsistent results for these studies may result from that they do not consider the preference of students' learning styles [1, 2, 3]. The purpose of this research is to investigate this problem. Specifically, the purpose of this paper is to compare the effect of computer-assisted collaborative concept mapping and computer-assisted individual concept mapping on improving students' critical thinking ability under different learning styles.

II. Method

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A. *Participants and Experimental Design*

Referring to [4], a pretest-posttest unequal control group quasi-experimental design was used. Participants were 95 accounting department students enrolled in a business and economics statistics course, 33 males and 62 females, from two classes at a university of education in Taiwan. One class (48 students) was assigned as the experimental class and the other class (47 students) was assigned as the control class.

B. *Instruments*

To investigate the purpose of this study, two instruments were used. A five-point Likert scale with a 12-item instrument called the learning style scale, which was developed by [5], was used to measure students' learning style. Based on [5], the learning styles of learners include accommodation, divergence, assimilation, and convergence. A seven-point Likert scale with 5 items instrument called CTS (Critical Thinking Subscale) from MSLQ (Motivated Strategies for Learning Questionnaire) developed by [6], was used to measure students' statistics critical thinking ability.

Inspiration software was used to construct concept maps for students. A one-way ANOVA (Analysis of Variance) was used to analyze the experimental data.

III. Results

A. *Descriptive Statistics*

Table I shows the descriptive statistics of critical thinking scores for computer-assisted collaborative and individual concept mapping groups. For all samples, the critical thinking mean score of collaborative concept mapping is 21.54, while the mean score of individual concept mapping is 22.44. For accommodators, the critical thinking mean score of collaborative concept mapping is 25.25, while the mean score of individual concept mapping is 17.25. For divergers, the critical thinking mean score of collaborative concept mapping is 24.56, while the mean score of individual concept mapping is 16.00. For assimilators, the critical thinking mean score of collaborative concept mapping is 18.08, while the mean score of individual concept mapping is 26.68. For convergers, the critical thinking mean score of collaborative concept mapping

is 20.89, while the mean score of individual concept mapping is 26.00.

TABLE I. DESCRIPTIVE STATISTICS

Sample	Group	Sample Size	Mean	Standard Deviation
All	Collaborative	48	21.54	4.16
	Individual	46	22.44	5.70
accommodators	Collaborative	8	25.25	3.58
	Individual	8	17.25	5.80
divergers	Collaborative	9	24.56	4.13
	Individual	3	16.00	5.57
assimilators	Collaborative	13	18.08	2.60
	Individual	19	26.68	2.77
convergers	Collaborative	18	20.89	2.99
	Individual	16	26.00	4.65

a. Sample of a Table footnote. (Table footnote)

B. Comparing Two Groups

Table II shows the results of comparing the effect of computer-assisted collaborative and individual concept mapping on improving students' statistics critical thinking ability. For all samples, the result shows that there is not significant difference for improving students' statistics critical thinking ability between computer-assisted collaborative and individual concept mapping, $t = -0.86$, $p > .05$. However, for accommodators and divergers, computer-assisted collaborative concept mapping has a significantly better effect on enhancing students' statistics critical thinking ability than computer-assisted individual concept mapping, $t = 3.32$, $p < .01$; $t = 2.88$, $p < .05$. Oppositely, for assimilators and convergers, computer-assisted individual concept mapping has a significantly better effect on improving students' statistics critical thinking ability than computer-assisted collaborative concept mapping, $t = -8.85$, $p < .01$; $t = -3.76$, $p < .01$.

TABLE II. T TEST FOR COMPARING CRITICAL THINKING MEAN OF COLLABORATIVE AND INDIVIDUAL GROUPS

Sample	Group	Sample Size	Mean Difference	Standard Error	t value ^b
All	Collaborative	48	-0.89	1.03	-0.86
	Individual	46			
accommodators	Collaborative	8	8.00	2.40	3.32** ^a
	Individual	8			
divergers	Collaborative	9	8.56	2.97	2.88*
	Individual	3			
assimilators	Collaborative	13	-8.61	0.97	-8.85**
	Individual	19			
convergers	Collaborative	18	-5.11	1.36	-3.76**
	Individual	16			

a. * $p < .05$ ** $p < .01$.

b The significant results of Mann-Whitney test are the same.

IV. Conclusions

The purpose of this paper is to compare the effect of computer-assisted collaborative concept mapping and computer-assisted individual concept mapping on improving students' critical thinking ability under different learning styles. The experimental results showed that the effect of computer-assisted collaborative and individual concept mapping on improving statistics critical thinking ability is not significantly different. However, when considering student learning style, experimental results showed that comparing to computer-assisted individual concept mapping, computer-assisted collaborative concept mapping provides better assistance to improve statistics critical thinking ability for students who have accommodating and diverging learning styles. Conversely, for students who have assimilating and converging learning styles, the computer-assisted individual concept mapping offers better benefit to improving their statistics critical thinking ability than the computer-assisted collaborative concept mapping. Implications for research and practice are discussed.

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