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The Effectiveness of a Single Intervention of Computer-Aided Argument Mapping in a Marketing and a Financial Accounting Subject (0003)

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1. INTRODUCTION

Argument maps/mapping (hereafter, AM) are visual tools enhancing critical analysis and evaluation of arguments. They differ from "mind maps" and "concept maps" in terms of level of detail and degree of precision (Davies, 2011, forthcoming).The AM "method" of clearly outlining a contention at the top of a map, followed by tiers of reasons and objections can be augmented with CAAM (Computer-Aided Argument Mapping) software programs that aid the mapping process. An example argument map from the discipline of Finance is provided below.

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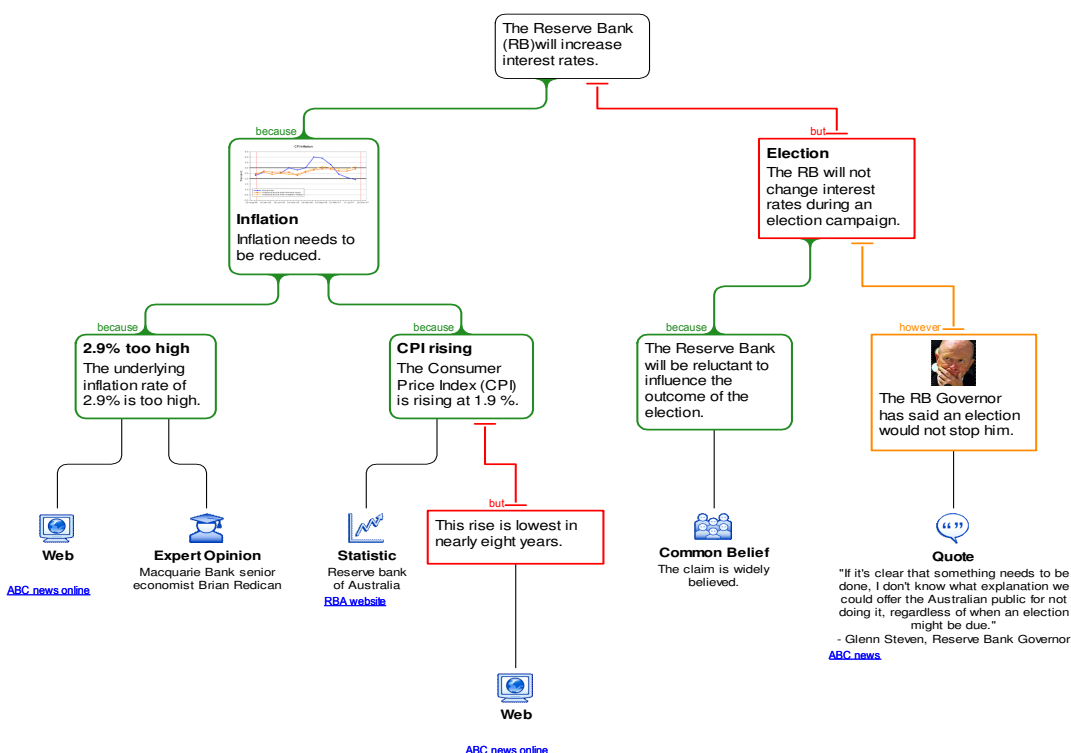
[1] A developed version of this paper has been published in *Higher Education Research and Development,* Vol 30(3), Special Issue in Critical Thinking (Carrington, Chen, Davies, Kaur, & Neville, 2011).

We trialled the teaching effectiveness of AM within two large cohort subjects in the Business and Economics Faculty of a large research-intensive university. Our focus was not to replicate the conditions of more extensive, semester-length expert-led trials using AM throughout the semester (Harrell, 2011; The monash critical thinking study," 2009; Twardy, 2004; van Gelder, Bissett, & Cumming, 2004). Rather, we were interested in establishing students' perceptions of whether—given the evidence supporting AM—a one-shot inoculation of AM in a regular class can enhance CT skills given realistic timetabling constraints.

2. METHOD

This project involved trialling the integration of AM into the curriculum of two Commerce-related disciplines: Accounting and Marketing, both with a large cohort of students. The two subjects used for the AM intervention were Financial Accounting (FA) and Marketing and Society (MS), both offered in the second semester of 2009. The student cohorts were large, 109 and 182 respectively.

Our intervention began with an expert-led session, fifty minutes in duration held within the normal timetabled tutorial of the two classes (FA and MS). An outline was first provided of mind mapping and concept mapping and how they differ from AMs. The CAAM software was then demonstrated. Statements were then distinguished from contentions (the latter involving an inference from premise(s), and a number of simple arguments, consisting of a single reason bearing on a contention, were outlined. This stage involved student participation. This led to a discussion of more complex, multi-strand arguments, with reasons, objections and rebuttals. Students were encouraged to map these more complex examples using the CAAM software.

We examined the effectiveness of AM by analysing data from a self-reported questionnaire in both FA and MS. We also present the initial results of an objective study using the California Critical Thinking Skills Test (CCTST), a well-established test of critical and analytical thinking, in the MS subject. The self-reported questionnaire was identical across both subjects and was conducted in the last two weeks of Semester 2, 2009. It consisted of nine likert scale questions and three general questions (optional). The nine likert scale questions adopted a five-point scale, with "1" being "Strongly Disagree" and "5" being "Strongly Agree", as well as "not applicable".

3. RESULTS

Table 1 Descriptive Statistics
Panel A: Mean score and response distribution for Financial Accounting group (n=100)

Q	Mean	Std	P-value	%Agree (4 and 5)	%Neutral (3)	%Disagree (1 and 2)	%NA
Q1 Overall effectiveness	3.83	1.10	<0.0001	68	19	13	0
Q2 Visual representation	3.87	1.03	<0.0001	72	18	10	0
Q3 Understanding	3.81	0.97	<0.0001	68	25	7	0
Q4 Component break down	3.80	1.07	<0.0001	63	27	10	0
Q5 Logical connections	3.83	0.92	<0.0001	71	19	10	0
Q6 Help essay writing	3.36	1.09	0.0016	42	40	16	2
Q7 Time saving in writing	3.16	1.12	0.1551	37	36	26	1
Q8 Apply to other areas	3.46	1.16	0.0001	53	27	20	0
Q9 Face difficulties	2.90	1.28	0.4348	36	19	45	0

Panel B: Mean score and response distribution for Marketing and Society group (n=123)

Q	Mean	Std	P-value	%Agree (4 and 5)	%Neutral (3)	%Disagree (1 and 2)	%NA
Q1 Overall effectiveness	3.55	1.05	<0.0001	59	24	18	0
Q2 Visual representation	3.85	0.98	<0.0001	72	17	11	0
Q3 Understanding	3.46	1.10	<0.0001	54	24	22	0
Q4 Component break down	3.64	0.94	<0.0001	61	27	12	0
Q5 Logical connections	3.54	1.00	<0.0001	59	24	16	0
Q6 Help essay writing	3.08	1.18	0.4427	37	31	32	1
Q7 Time saving in writing	2.76	1.12	0.0171	28	28	43	0
Q8 Apply to other areas	3.01	1.11	0.8711	38	27	35	0
Q9 Face difficulties	2.44	1.08	<0.0001	18	25	56	1

3.2 Regression analysis

We ran a regression analysis to test the most important variables in explaining the overall effectiveness of AM. The regression model is constructed with the response to Q1 as the dependent variable and the responses to Q2 to Q9 as independent variables.

Table 2 Regression Analysis

Model: $Q1 = b_1 + b_2Q2 + b_3Q3 + b_4Q4 + b_5Q5 + b_6Q6 + b_7Q7 + b_8Q8 + b_9Q9 + e$

Panel A Financial Accounting Group

		Coefficient	t-statistics	p-value
Intercept	b_1	-0.0594	-0.1828	0.8553
Q2 Visual representation	b_2	0.3186***	2.9139	0.0045
Q3 Understanding	b_3	0.2743**	2.1349	0.0356
Q4 Component break down	b_4	0.0494	0.5028	0.6163
Q5 Logical connections	b_5	0.1492	1.2235	0.2244
Q6 Help essay writing	b_6	0.1225	1.1260	0.2632
Q7 Time saving in writing	b_7	-0.0173	-0.1689	0.8663
Q8 Apply to other areas	b_8	0.1307	1.2666	0.2086
Q9 Face difficulties	b_9	0.0147	0.2738	0.7849

** and *** indicate significance at the 0.05 and 0.01 levels (two tailed), respectively.

Panel B Marketing and Society Group

		Coefficient	t-statistics	p-value
Intercept	b_1	0.1755	0.5807	0.5626
Q2 Visual representation	b_2	0.2432***	2.6580	0.0090
Q3 Understanding	b_3	0.2236**	2.4600	0.0154
Q4 Component break down	b_4	0.3831***	3.3699	0.0010
Q5 Logical connections	b_5	-0.0530	-0.4993	0.6186
Q6 Help essay writing	b_6	-0.0747	-0.8849	0.3781
Q7 Time saving in writing	b_7	0.1124	1.2920	0.1990
Q8 Apply to other areas	b_8	0.1400*	1.7556	0.0819
Q9 Face difficulties	b_9	-0.0109	-0.1987	0.8429

*, ** and *** indicate significance at the 0.10, 0.05 and 0.01 levels (two tailed), respectively.

3.3 Measuring Pre- and Post-AM Skills (MS Group)

The MS student cohort was also asked to participate in a pilot of the online California Critical Thinking Skills Test (CCTST) to independently evaluate the effectiveness of the integration of AM techniques. The students completed the CCTST online test twice: initially before AM was introduced to the students (pre-test) and at the end of the semester (post-test), with a period of 10 weeks between tests.

Table 4: *Descriptive statistics for Test 1 and Test 2 (n=25)*

	TEST 1		TEST 2		
Critical Thinking Attribute	**Mean**	**Std**	**Mean**	**Std**	**P-Value**
Induction	13.12	2.32	13.84	2.78	0.0170**
Deduction	10.28	2.61	10.60	2.43	0.1142
Analysis	8.00	1.66	8.36	1.41	0.0425**
Inference	9.68	2.64	10.20	2.27	0.0069***
Evaluation	5.72	1.40	5.88	1.99	0.4482
TOTAL	23.40	4.38	24.44	4.91	0.0209**

*, ** and *** indicate significance at the 0.10, 0.05 and 0.01 levels (two tailed), respectively.

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