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Creativity Computer-Assisted Instruction Systems (CCAI) in Taiwan: System Development & An Experimental Study

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To respond effectively in today's quickly changing, highly complex business environment, management must depend on organizational members' mental capacities to generate new and meaningful ideas. Consequently, creativity has evolved into a fundamental organizational resource useful in establishing and maintaining competitive advantage. One relatively new set of tools intended to augment the creative process is Creativity Computer-Assisted Instruction Systems (CCAI). These computer-based tools are generally aimed at enhancing boundary-breaking, insightful thought during problem solving. However, if a CCAI were to directly enhance creative performance, the benefits could be multifaceted. For example, students could use the CCAI for reinforcing techniques learned in formal creativity training. Or, by matching CCAI tools to specific lesson needs, the CCAI might enable teachers to better enhance student's creative performance.

Due to (1) the effects of culture gap on system performance and user satisfaction, (2) the lack of clear empirical evidence concerning the value of a CCAI, there is also little theoretical justification. Each CCAI appears to provide a different methodology for enhancing creativity with little more than anecdotal reasoning to justify the approach; a laboratory experiment was conducted to evaluate the performance of CCAI developed in Taiwan.

The results suggest that responses generated with software support are significantly more novel and valuable than responses without software support. It is hoped the findings from this investigation can be used to improve individual creative performance, further research concerning factors relevant to creativity, and guide future CCAI development efforts.

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1. Introduction

Generating more alternatives and better alternatives is an important part of managerial problem solving and decision making. Everyone is capable of making decisions but not everyone seems to be capable of developing creative alternatives. Organizations such as Microsoft and Minnesota Mining and Manufacturing, for example, claim that cultivating creativity within their members has led to innovations otherwise not possible (LaBarre, 1994; Morgan, 1993).

This paper investigates whether Creativity Computer-Assisted Instruction systems (CCAI) for idea generation can help individuals to develop solution alternatives more creatively. To the extent that computer software might enhance the creative performance of individual users, teachers might ultimately apply such tools to enhance the creative performance of their students.

2. Theoretical foundation of the CCAI

Different levels of analysis were used to address the creativity concepts; within levels different components were put forth; and even when similar components were discussed, differences were seen in how these components were defined and how crucial they were claimed to be for the larger concept of creativity. Given these differences, which are as varied as creative expression itself, one might ask is there is any consensus whatsoever, if we know anything at all about creativity, or if it is even a useful concept for scientific theory and research.

One area of general agreement, though, is the importance of four key concepts (Couger, 1995); (i) output, (ii) process, (iii) individual, and (iv) environment. Creative output is most likely the result of an imaginative individual working in a supportive environment, engaged in processes conducive to creativity. A comprehensive model of creative problem solving has to consider all four components. In our model, the output is ideas that are original, useful, and feasible. The process has multiple phases which include problem structuring, idea generation, and evaluation. The problem solver's individual characteristics include demographics, knowledge, and personality. The environment includes both physical and social factors.

In any study of creativity all four components must enter to some extent, although most studies emphasize only one or two of these elements. Our prime concern will be with processes conducive to creativity. A second concern will be with supportive environments and with the criteria for judging creative outputs; relatively little attention will be devoted to creative individuals per se.

3. The Structure of the CCAI Program

The techniques described in the preceding section have been incorporated into a computer program developed to support idea generation in individual problem solving. The program, called "CCAI" for Creativity Computer-Assisted Instruction Systems, consists of three main parts: (1) a creativity concept module, (2) an idea generation technique module, and (3) a stimulus base. The suggestive learning process is as following: understanding the important of creativity, breaking the rock of your mind, understanding the concept of creative personality, and learning the creativity enhancing techniques.



4. Empirical Test of the CCAI Program

We conducted an empirical test of the idea generation techniques incorporated in the CCAI program directed at the central hypothesis:

A set of idea generation techniques, developed in the form of computer software, can help to increase the yield of creative ideas.

As a baseline for comparison we developed a control program by modifying a standard word processor. Thus, the following hypotheses were specifically addressed in the empirical investigation: (1) Creativity software can improve the idea generation process, (2) Creativity software can outperform a word processor control treatment.

5. Results

Table 1 Torrance Test & Open-end problem T-test result

Type of Test	Pre/post	Mean	Std	-value
Figure	Pre-test	84.7	36.8	7.57*
	Post-test	116.3	38.2	
Text	Pre-test	52.3	31.9	6.7*
	Post-test	71.5	35.5	
Figure Text	Pre-test	136.9	54.9	8.6*
	Post-test	187.9	61.2	
Figure fluency	Pre-test	21.7	10.3	8.2*
	Post-test	30.5	9.8	
Figure flexibility	Pre-test	17.1	7.6	7.3*

	Post-test	22.5	6.9	
Figure Originality	Pre-test	33.7	16.8	6.0*
	Post-test	45.2	18.0	
Figure Elaboration	Pre-test	12.1	8.3	4.0*
	Post-test	18.2	13.1	
Text fluency	Pre-test	19.5	11.6	7.5*
	Post-test	26.6	12.9	
Text flexibility	Pre-test	15.9	8.9	5.3*
	Post-test	21.1	11.0	
Text Originality	Pre-test	17.0	12.6	6.0*
	Post-test	24.0	13.7	
Open-end problem	Pre-test	7	4.3	5.2*
	Post-test	15	5.7	

* indicates $p < 0.05$

6. Discuss

The research reported in this paper demonstrates that a portfolio of methods implemented through computer software can help individuals to generate creative ideas for a variety of managerial problems. A significant proportion of the best ideas was generated through the use of the CCAI program rather than through the control treatment (a computer-based word processor).

Because organizations seek more innovative ways to compete, the ability of their employees to generate new and valuable ideas becomes a fundamental survival skill.

To the extent that computer software might enhance the creative performance of individual users, teachers might ultimately apply such tools to enhance the creative performance of their students.

It is hoped the findings from this investigation can be used to improve individual creative performance, further research concerning factors relevant to creativity, and guide future CCAI development efforts.

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