Training and Measuring Creativity Using Computer-Based Morphological Analysis Method

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What is Creativity?

It is divergent thinking based on Guilford's Divergent Production Theory (Guilford, 1967; 1988; Torrance, 1988; 2000)

It is the concept of lateral thinking (opposed to vertical logical thinking) (DeBono, 1990)

The more ideas you produce, the more creative you are!

However

Ideas that are produced must be original, unique although they may sound vague, impractical, elements of imagination or even crazy! (Aleinikov, 2002; Rawlinson, 2004)

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Research Questions

In what ways could ICT (multimedia) help to improve creativity?

What components of creativity were used to indicate creativity improvement?

How did the creative potentials of a person improve?

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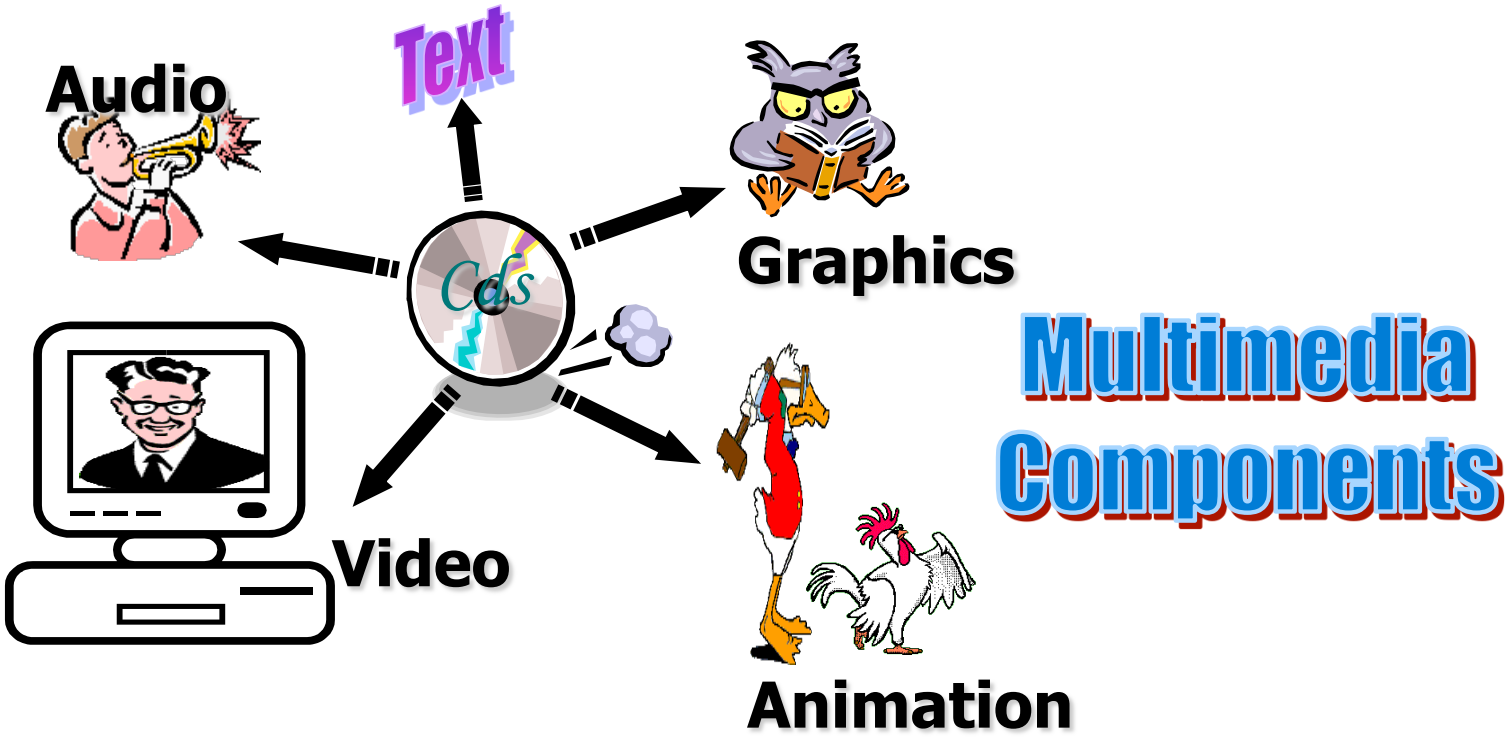
The use of multimedia for training creativity



Carefully designed multimedia courseware aids learner greatly (Liou, 1994; Mayer, 1997; 1999)

Training creativity → Brainstorming

Brainstorming was created by Alex Osborn in 1937; most popular method for creative problem solving (findings by the Swiss Federal Institute of Technology, June 2003)

Principles of brainstorming:

- **Criticism is ruled out**
- **Freewheeling is welcomed (Judgement of ideas are delayed)**
- **Quantity is wanted**

Training creativity → Morphological Analysis

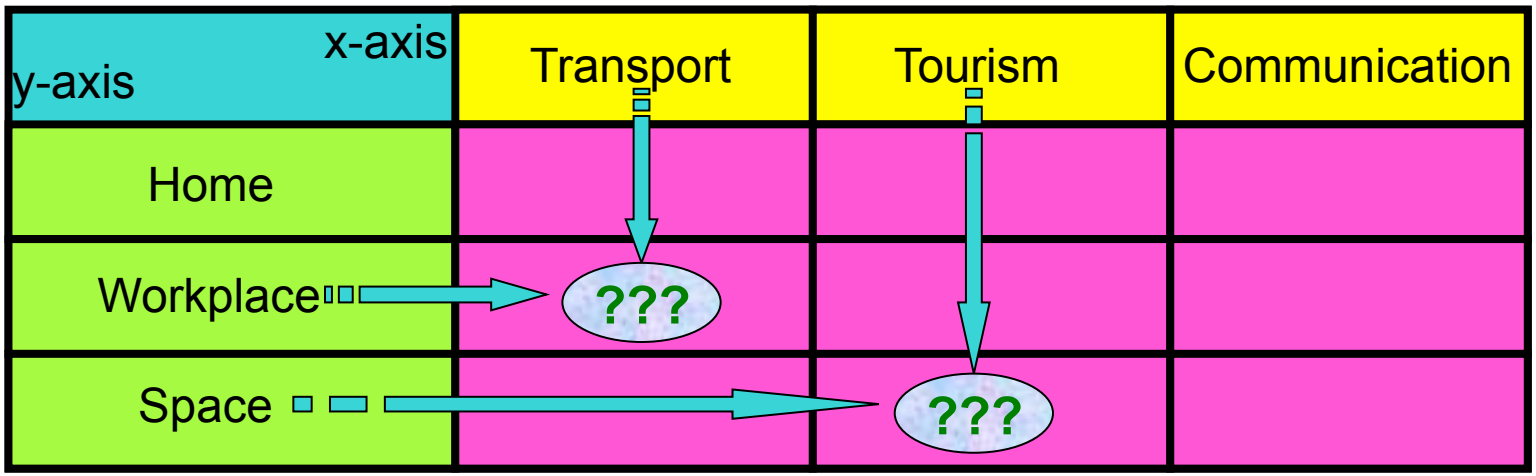
Morphological Analysis (MA) Method was created Dr. Fritz Zwicky in the 1930's:

- **used widely for policy analysis and problem solving**
- **generates a very large number of ideas**
- **a problem is *broken down* into component variables and then *association* is when the variables are matched to form new ideas (Roy, 2004)**

Training creativity → An Example on Morphological Analysis

Problem: What can we do in Year 2050 ?

The problem can be broken down into components such as:
Type of activity → Transport, tourism and communication
Place of activity → home, workplace and space
This transforms into a 3 x 3 Matrix, that is 9 ideas
The matrix will look like this:



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Criteria for measuring creativity

Definitions for fluency, flexibility, elaboration and originality adapted from Guildford's Alternative Uses Task (1967) in Dow (2006) and Torrance's Test of Creative Thinking (Torrance & Ball, 1984)

Creativity components	Scoring criteria	Score awarded
Fluency	The number of different ideas that one can produce (based on Quantity)	1 point for each idea
Flexibility	The number of categories of ideas that one produces	1 point for each category
Elaboration	Richness of detail in the ideas that one produces	1 point for each creative elaboration
Originality	the uniqueness of the ideas that one produced as compared to the whole sample	≤ 1% of sample (2 points) 1 to 5% of sample (1 point)

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Example of the Calculation

If a subject contributed 3 ideas as follows:
Idea 1: Flying car (Air transport)
Explanation = "Powered by jet propeller"
Idea 2: Solar 3-wheel bike (Ground transport)
Explanation = "Save fuel cost, environmental friendly"
Idea 3: Ali Baba's Flying carpet (Air transport)
Explanation = "Fly by reciting powerful holy verses from Heaven"

Total ideas = 375, Maximum Creativity Index Score in the sample (n = 97) = 27

After computing by Creativity Assessment System, the results were:

Item	Creativity Components				
	Fluency	Elaboration	Flexibility	Originality	Creativity Index
Idea 1	1	1	1	0	11
Idea 2	1	1	1	1	
Idea 3	1	1	0	2	
TOTAL	3	3	2	3	

Calculation on originality score:
Idea 1 represents 6.7% (25/375 * 100) of total ideas (25 subjects gave the same idea)
Idea 2 represents 1.6% (6/375 * 100) of total ideas (6 subjects gave the same idea)
Idea 3 represents 0.8% (3/375 * 100) of total ideas (3 subjects gave the same idea)
Rules for scoring originality:
Less than 1% = 2, between 1% and 5% = 1, more than 5% = 0

Conclusion: This subject belongs to "Moderate Creative" category
(Creative = 19 to 27, Moderate Creative = 10 to 18, Less Creative = 0 to 9)

Instrument

The Integrated System

Brainstorming System:
Topic: "Future Transportation in Malaysia"

alpha value, r = .497 (p < .01)

output → **Ideas**

Creativity Traits:
Fluency, Elaboration, Flexibility and Originality

output ←

Creativity Assessment System

Instrument 1

Instrument 2

Post-experiment Survey:
6 questions (Yes/No and open-ended type)

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Findings and Discussion: The multimedia approach

Multimedia modules for teaching MA Method: Creativity definitions + examples (MA Method) (ANIMATED IN VIDEO FORMAT)
87.6% (85 subjects) improved in posttest

Video was accepted as a highly effective tool for illustrating concepts (Roblyer, 2003; William & Abraham, 1995 in Brooks *et al.*, 2001)

Practice 1	Practice 2
252 ideas	375 ideas

Extra feature:
The videos can be replayed anytime

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Findings and Discussion: Morphology Analysis Method

Improvement in creative potentials

Creativity Components	Pretest (SD)	Posttest (SD)	Difference	T-test Result at 95% confidence level
Fluency	3.87 (1.68)	6.46 (2.71)	2.59	Significant (t = -10.94, p < .05)
Elaboration	3.82 (1.70)	6.42 (2.68)	2.60	Significant (t = -10.90, p < .05)
Flexibility	3.22 (1.42)	4.49 (1.28)	1.27	Significant (t = -8.61, p < .05)
Originality	7.00 (3.27)	12.03 (5.23)	5.03	Significant (t = -10.30, p < .05)

Results of Survey:

The effectiveness of MA Method:

- **organised thoughts on ideas (intersection between variables) → 74.2%**
- **systematic and easy to use → 63.9%**
- **helped to focus on ideas → 75.3%**

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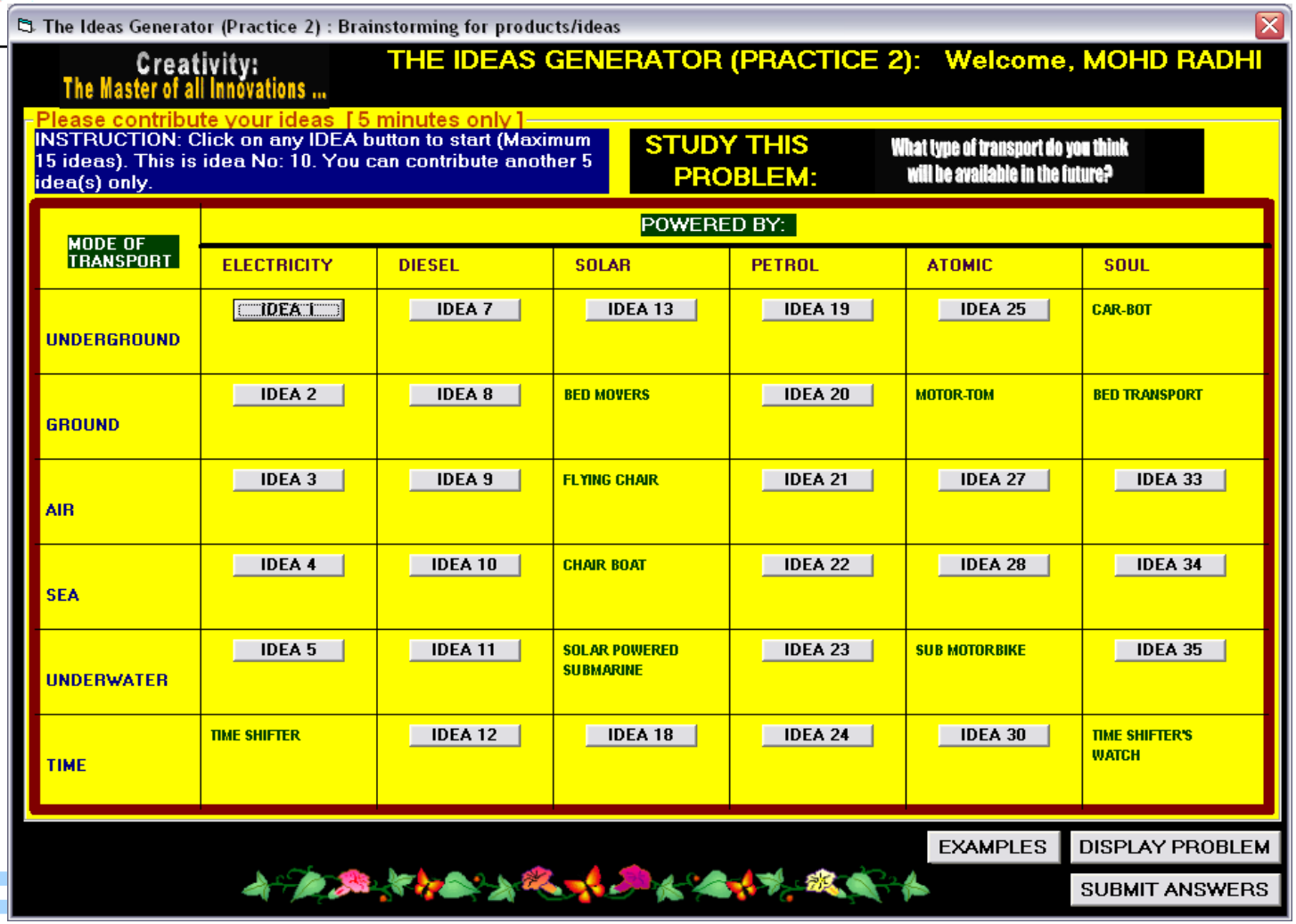
The Interface for the MA Method



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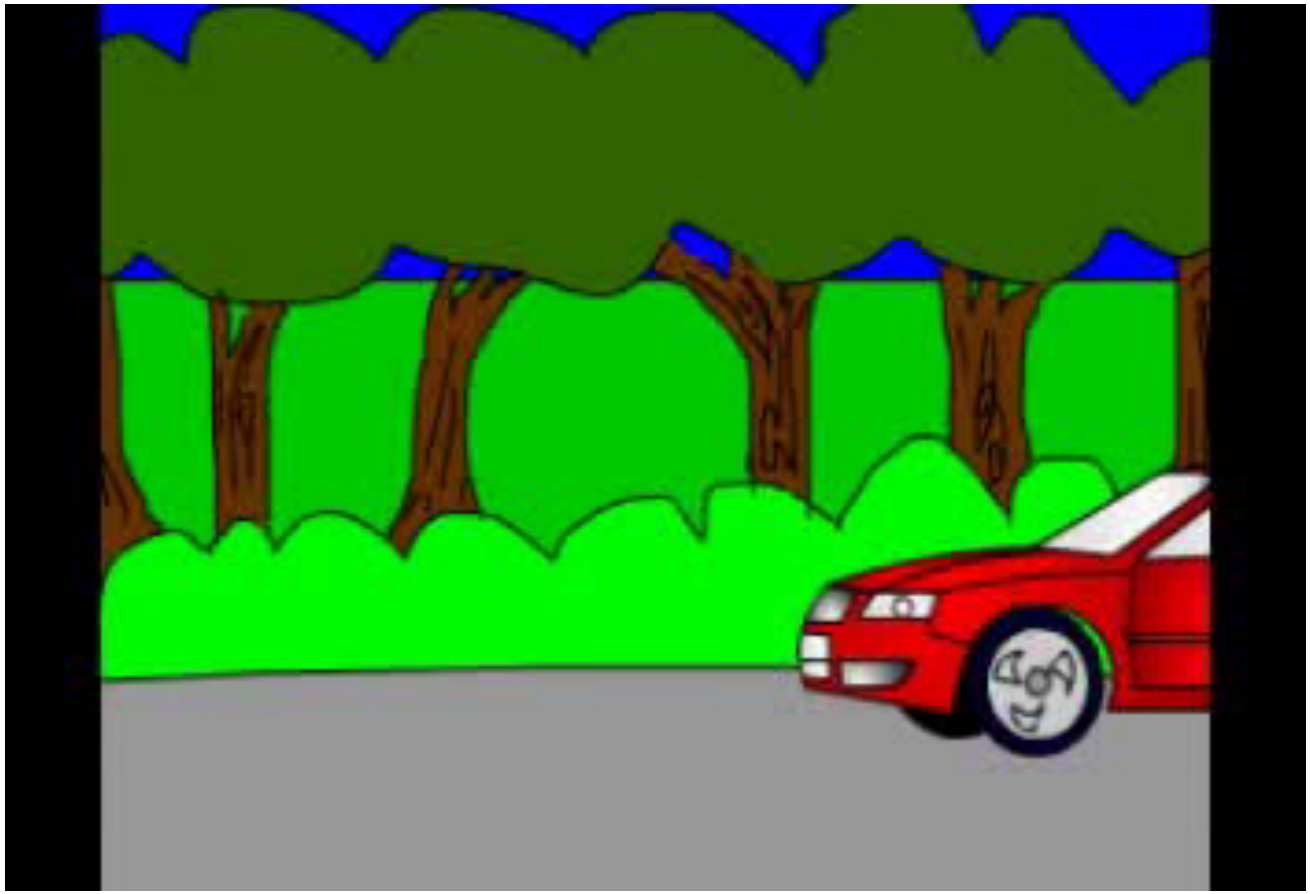
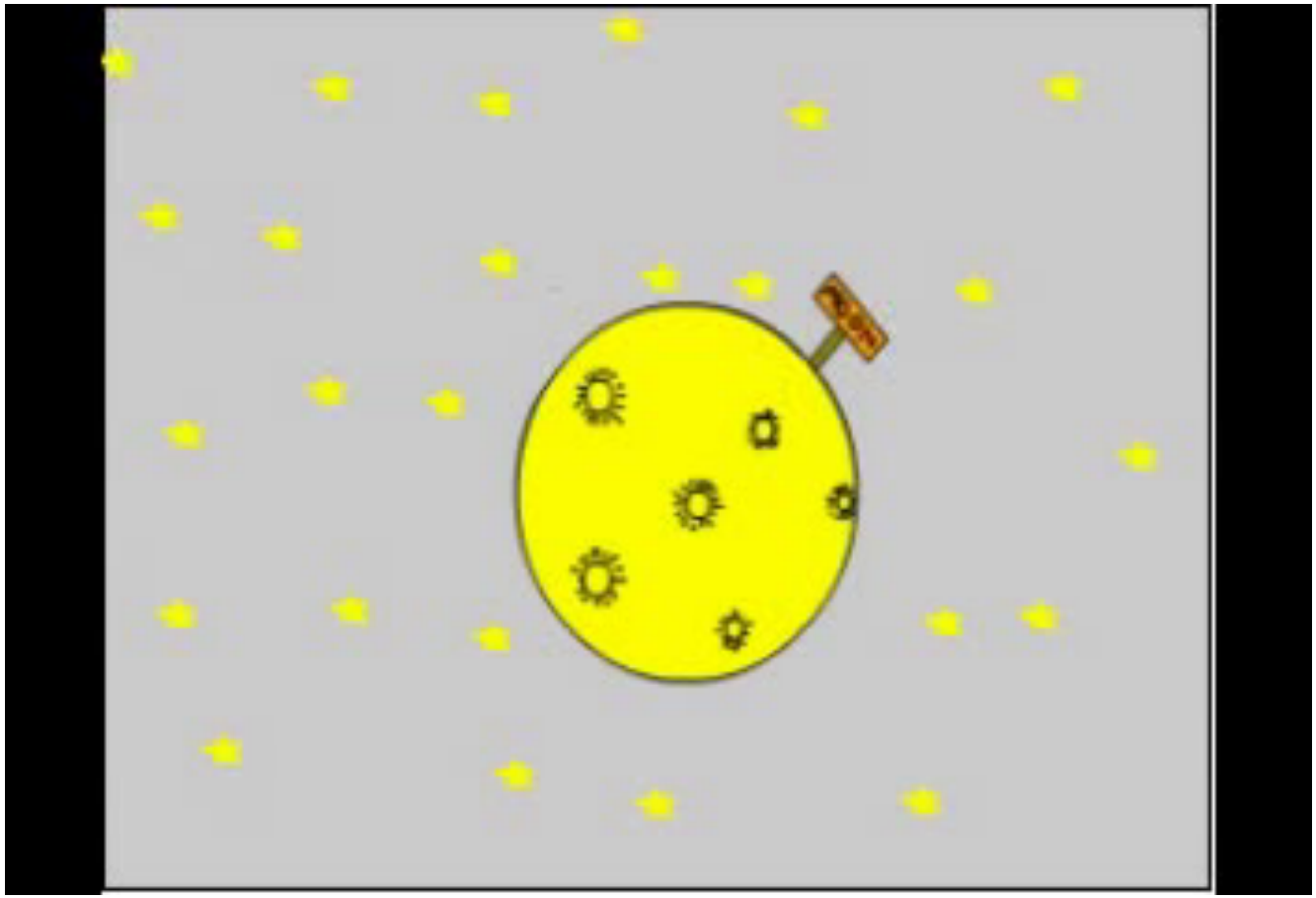
Findings and Discussion: Morphology Analysis Method

MA Method uses the matrix in creative problem solving. It was proved effective in this research.

Recommendation:

This method can be adapted to suit academic activities (in schools or universities/colleges) that require brainstorming for ideas. The repeated uses of this technique will be able to improve the creative potentials of a person in the long term

Thank you for your kind attention