

Enhancing task solving efficiency by the stimulation of crystallized and/or fluid intelligence using environmental factors

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ABSTRACT

Aim. The study analyzes the influence of environmental factors on crystallized and/or fluid intelligence stimulation and their apport in increasing efficiency.

Material and method. Two groups of students were stimulated by environmental factors aiming to temporarily increase fluid intelligence, or both crystallized and fluid intelligence. The effects were evaluated using a special designed test.

Results and conclusion. For a task that requires attention, being under time pressure, fluid intelligence stimulation is crucial, improving the results by 21.88%. The benefit of supplementary stimulating crystallized intelligence, brought only an increase 10 times weaker, of 2.03%, up to 23.91% in performance improvement. This advantage was obtained by consuming a double time versus the group receiving only stimulated fluid intelligence.

We managed to reduce by over 20% the errors by stimulating fluid intelligence by environmental factors.

Keywords: fluid intelligence, crystallized intelligence, efficiency

INTRODUCTION

We started this study because an observation made during a research on fatigue. Some colleagues began working at the patient with high initial physical and especially mental fatigue levels, which of course affects work performance. Under these circumstances, we studied the possibilities of psychic level augmentation

and removal of mental fatigue in order to increase work efficiency. Our attention was drawn to a new scientific branch of cognitive ergonomics (1), neuroergonomics (2) dealing with the interaction between the human mind and work process and human performance (3). A related field (with much discussed ethical aspects) cognitive enhancement, has exactly the activity ob-

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ject needed in study. Much blamed (4) for the dream to provide „intelligence in a pill“, it also offers other methods, without risk, to increase cognitive capacities.

One of these safe methods is the use of environmental factors, which can stimulate the fluid intelligence (dealing with reasoning, and new problem solving).

MATERIALS AND METHOD

Among the environmental factors that influence the fluid intelligence, one is creating an environment of „friendly competition“ (5). The competition actually stimulates creativity and „friendship“ is intended to combat the negative aspects of competition.

We wanted to investigate the quantum of additional benefit brought by the supplementary stimulation of the crystallized intelligence (based on learning and previous experience). For this purpose we selected two groups of students who were motivated differently. We designed a questionnaire in which students had to count each of the letters: b, d, p and q present in each box of a table with 36 boxes, and find out how many times each letter repeats (Fig. 1).

B =? ; D =? ; P =? ; Q =?

b	d	p	q	d	q
d	p	q	d	b	p
d	q	p	d	q	p
b	p	q	b	d	b
q	d	q	b	p	p
q	p	b	p	p	d

FIGURE 1

We asked for the prior informed consent of all participating students. To increase the crystallized intelligence we used as method a discussion on a subject of immediate and intense interest for the students: the next exam. All the students were very attentive and active.

A. The first group was composed of 26 students. The experimental protocol was as follows, for the group to which stimulated both the fluid and crystallized intelligence.

- a. We described this test to the students.
- b. We have provided a set of tests similar to those used in the real test, but with dif-

ferent frequency and positioning of the four letters, so that students can complete in order to familiarize them with the type of test. We offered for this test about 2 minutes (afterwards letting the tests to the students).

- c. We had discussion on the themes for the next exam for approximately 10 minutes
- d. We administered the first test, for which we offered 1½ minutes to solve.
- e. We presented the perspicacity problem, whose solution required approx. 9 minutes.
- f. We administered the second test, for which we offered also 1 ½ minutes to solve.

B. The second group was composed of 23 students. The experimental protocol was as the same, for the group to which only stimulated fluid intelligence, excepting the point c which was omitted. From point d on the test was similar.

1. The results of the group with stimulation fluid intelligence tests 1 and 2 are presented in Tables 1 and 2 and in Chart 1.

TABLE 1

1	NAME, GR.	TEST 1	TEST 2	RESULTS
2	DA 10	0	1	DECREASE
3	DCE 10	0	0	THE SAME
4	DM 10	0	0	THE SAME
5	CC 11	0	0	THE SAME
6	VR 12	0	1	DECREASE
7	CA 13	0	2	DECREASE
8	BB 14	0	2	DECREASE
9	BA 11	1	1	THE SAME
10	CA 11	1	0	INCREASE
11	DA 11	1	3	DECREASE
12	CA 11	1	1	THE SAME
13	EJ 12	1	2	DECREASE
14	DDC 10	2	0	INCREASE
15	C C 12	2	2	THE SAME
16	GS 12	2	0	INCREASE
17	MCC 14	2	4	DECREAS
18	BM 14	2	0	INCREASE
19	TO 12	3	0	INCREASE
20	AC 13	3	2	INCREASE
21	AI 11	4	4	THE SAME
22	DAE 11	4	4	THE SAME
23	GM 12	4	1	INCREASE
24	AR 13	5	0	INCREASE
25	D D 13	5	2	INCREASE
26	GI 10	7	1	INCREASE
27	CI 11	7	2	INCREASE
	TOTAL ERRORS	57	35	

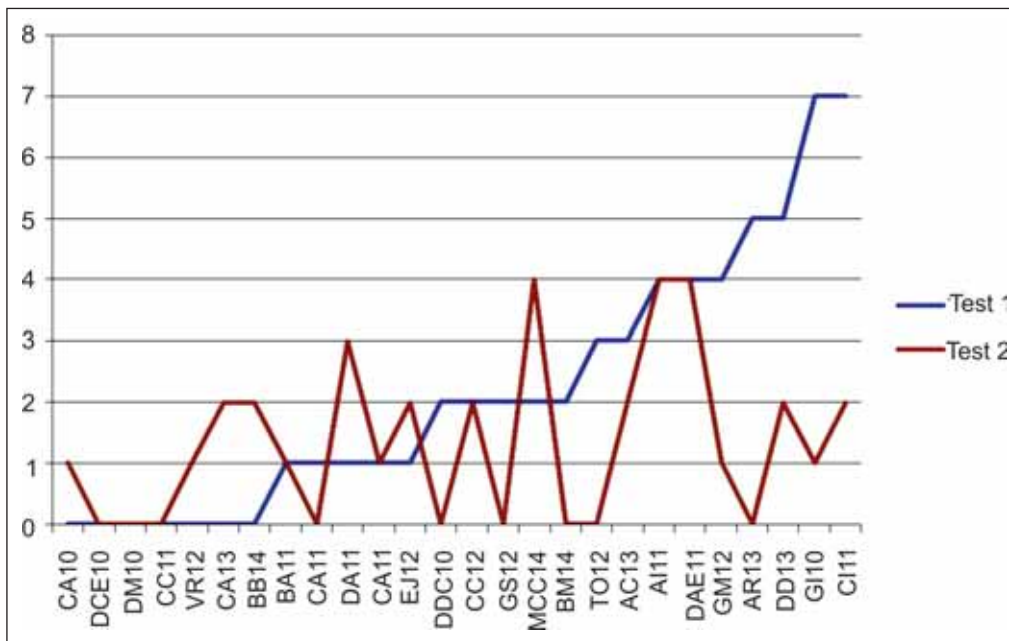


CHART 1. The number of errors in the group with the fluid intelligence stimulation-tests 1 and 2

TABLE 2

TEST 1 FLUID INT.			TEST 2 F FLUID INT.		
Nr. mistaken points	Nr. students	Percentage test 1	Nr. mistaken points	Nr. students	Percentage test 2
0	7	27%	0	9	35%
1	5	19%	1	7	23%
2	5	19%	2	6	27%
3	3	8%	3	1	4%
4	3	11%	4	3	11%
5	2	8%	Results of the group with fluid intelligence stimulation		
7	2	8%			

Students who correctly solved the first test were 7 (27%), and those who correctly solved the second test were 9 (35%), an increase of 7%

The results of the group “with both the crystallized intelligence and fluid intelligence stimulation – tests 1 and 2 are shown in Tables 3 and 4, as well as in the Chart 2.

TABLE 3

	NUME GR.	TEST 1	TEST 2	RESULTS
1	RAI 25	0	1	DECREASE
2	TFA 25	0	0	THE SAME
3	SCM 28	0	0	THE SAME
4	TG 28	0	0	THE SAME
5	SR 29	0	0	THE SAME
6	SV 29	0	0	THE SAME
7	TIA 29	0	1	DECREASE
8	VAE 30	0	4	DECREASE
9	RRA 25	1	0	INCREASE
10	FG 30	1	0	INCREASE
11	VII 30	1	0	INCREASE
12	ZB 30	1	2	DECREASE

	NUME GR.	TEST 1	TEST 2	RESULTS
13	RCM 25	2	0	INCREASE
14	SC 25	2	4	DECREASE
15	CD 28	2	1	INCREASE
16	MAS 27	3	2	INCREASE
17	MIA 28	3	2	INCREASE
18	SM 28	3	1	INCREASE
19	PI 29	3	0	INCREASE
20	SI 28	4	2	INCREASE
21	TIM 28	4	2	INCREASE
22	VB 30	4	2	INCREASE
23	UDR 29	5	1	INCREASE
Total errors		39	35	

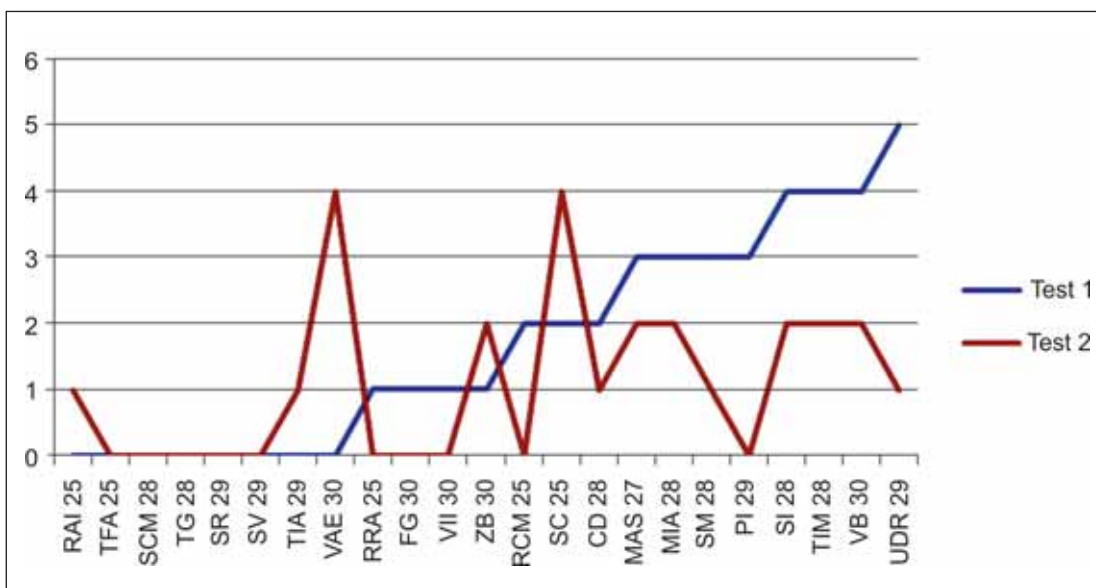


CHART 2. The number of errors – group with both the crystallized intelligence and fluid intelligence stimulation – tests 1 and 2

TABLE 4

TEST 1 C+F			TEST 2 C+F		
Nr. mistaken points	Nr. students	Percentage test 1	Nr. mistaken points	Nr. students	Percentage test 2
0	8	35%	10	0	42%
1	4	18%	5	1	21%
2	3	13%	6	2	25%
3	4	17%	0	3	0%
4	3	13%	2	4	8%
5	1	4%	0	5	4%
	39		25		

The students who correctly solved the first test, 8, 35%, as in the case of the first group (1/3). The second test correctly solved 10 students, 42%, an increase of 7.

DISCUSSION OF RESULTS

The essential is the number of points each measurement differs from the correct answer. Total errors (in points of difference) for each group and for each of the two tests, are presented in Charts 3 and 4.

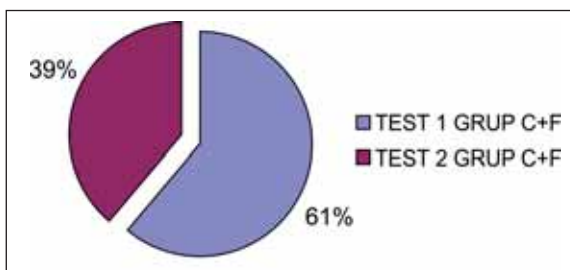


CHART 3. Number total of errors – group with crystallized + fluid intelligence stimulation

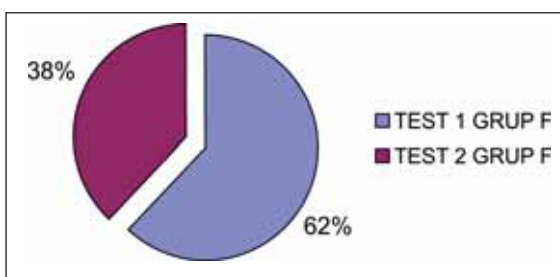


CHART 4. Number total of errors – group with fluid intelligence stimulation

In test 2 to for the group with stimulation fluid intelligence were wrong in just 35 points total to 57 in the first test, the error is reduced with 22 points, in the group with stimulation of fluid and crystallized intelligence, were wrong in the second test only 25 points total to 39 in the first test, the error reduction with 14 points (21.88% from total errors of this group).

CONCLUSIONS

Stimulation of the two types of intelligence is a proven fact in psychological research. The factors involved in the two processes are different.

Our results indicate that for a task that requires attention, being under time pressure, fluid intelligence stimulation is crucial, improving the results by 21.88%. The benefit of supplementary stimulating crystallized intelligence, one

that is based on prior learning and experiences brought only an increase 10 times weaker 2.03%, up to 23.91% in performance improvement. This advantage is obtained by consuming a double time versus the group receiving only stimulated fluid intelligence.

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