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DEVELOPMENT AND EVALUATION OF INSTRUMENTS FOR ASSESSING EFFICIENCY OF INSTRUCTIONAL STRATEGY BASED ON THE TRIPLET MODEL OF KNOWLEDGE REPRESENTATION

Dušica D. Milenković, Mirjana D. Segedinac, Tamara N. Hrin
Faculty of Sciences, University of Novi Sad, Serbia

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Methodology

Aim of research:

- Evaluation of instruments applied for the assessment of instructional efficiency

Participants:

- 94 secondary school students

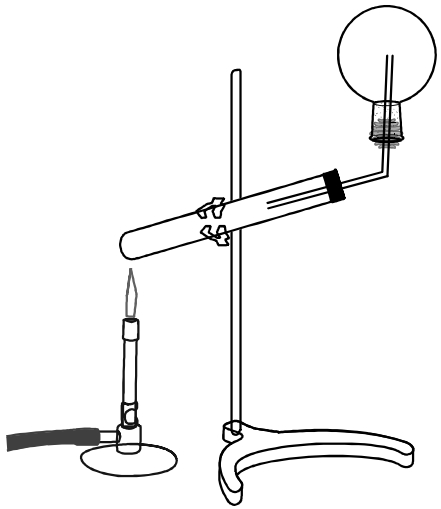
Instruments:

- Two-tier multiple choice test of knowledge
- Likert scale for measuring invested mental effort

Methodology

Test item example:

A mixture of ammonium chloride and calcium hydroxide is placed into a test tube (see figure). The mixture in the test tube is then heated for several minutes. What is going to occur? Circle the letter of the correct answer.



a) Gas is going to be produced.
b) A colored compound is going to be produced.
c) Crackling is going to occur.
d) There is no change.

The reason for your answer is:

I) Collisions of the molecules in the solid phase are explosive.
II) Colored chlorine ions are formed in reaction.
III) Molecules of ammonia are obtained in reaction.
IV) The particles of solids cannot react each other.

Methodology

Mental effort measure:

Extremely easy	**1**
Very easy	**2**
Easy	**3**
Neither easy, nor diffult	**4**
Difficult	**5**
Very difficult	**6**
Extremely difficult	**7**

Cognitive complexity measure:

- Five-level cognitive complexity scale
- Role of distractor (adding value: 0, 1 or 2)

Results and Discussion

Reliability:

➢ Cronbach's alpha = 0.84 ⟶ Good reliability

Item difficulty:

Table 1. *Difficulty indices (%)*

T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15
72,34	61,70	76,60	60,64	58,51	45,74	68,09	71,28	56,38	74,47	51,06	79,79	35,11	26,60	27,66

<30%

Item discrimination:

Table 2. *Discrimination indices*

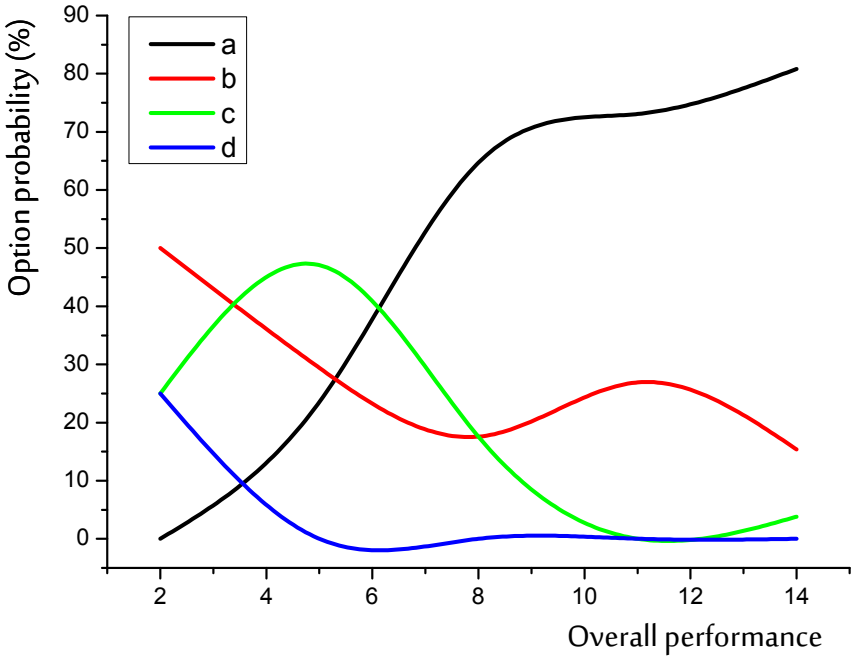
T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15
0,52	0,8	0,6	0,72	0,68	0,88	0,76	0,44	0,84	0,68	0,8	0,64	0,8	0,36	0,28

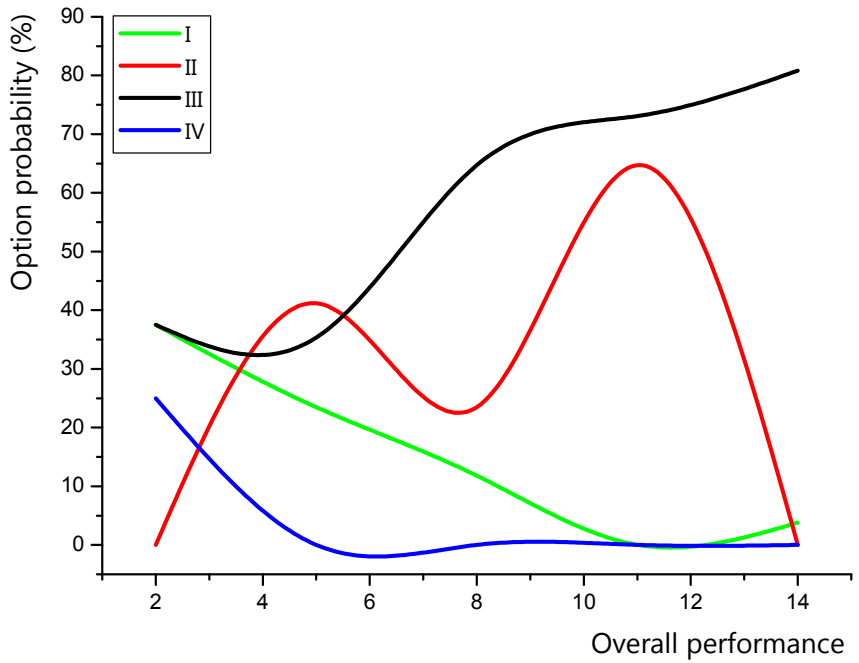
>0.20

Results and Discussion

Distractor analisys:

- Satisfactory conceptual understanding in 7 items (>75%)
- Misconceptions in 2 items (>20%)





Results and Discussion

Test for normality:

- SW: Performance, *p=0.204*
- SW: Mental effort, *p=0.105*
- SW: Cognitive complexity, *p=0.199*

p>0.05 → *Normal distribution*

Simple Regression analysis:

- Performance – Cognitive complexity
- Performance – Mental effort
- Mental effort – Cognitive complexity

Results and Discussion

Table 3. *Parameters of the regression analysis*

	Correlation coefficient	*p*-value	Equation of RA
Peformance - cognitive complexity	**- 0.52**	**0.04**	$P = 0.91 - 0.071 \cdot CC$
Performance - Mental effort	**- 0.61**	**0.01**	$P = 2.32 - 0.42 \cdot ME$
Mental effort - Cognitive complexity	**0.62**	**0.01**	$ME = 4.74 - 0.93 \cdot CC$

Moderate correlation

$p<0.05$

There is statistically significant relationship among all examined pairs of variables

Summary

- Metric characteristics of applied instrument: Reliability coefficient, difficulty index, discrimination index, role of distractors.

- Simple regression analisys

Implications:

- To determine misconceptions in both groups of students (experimental and control) and to compare differences in conceptual understanding of appropriate chemical concepts between two groups.

Acknowledgement

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Thank you for your attention

dusica.milenkovic@dh.uns.ac.rs