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APPLICATION OF THREE-TIER TEST TO ASSESS STUDENTS' MISCONCEPTIONS ABOUT LIPIDS

Dušica D. Milenković, Tamara N. Hrin, Mirjana D. Segedinac, Saša Horvat

University of Novi Sad, Faculty of Sciences, R. Serbia

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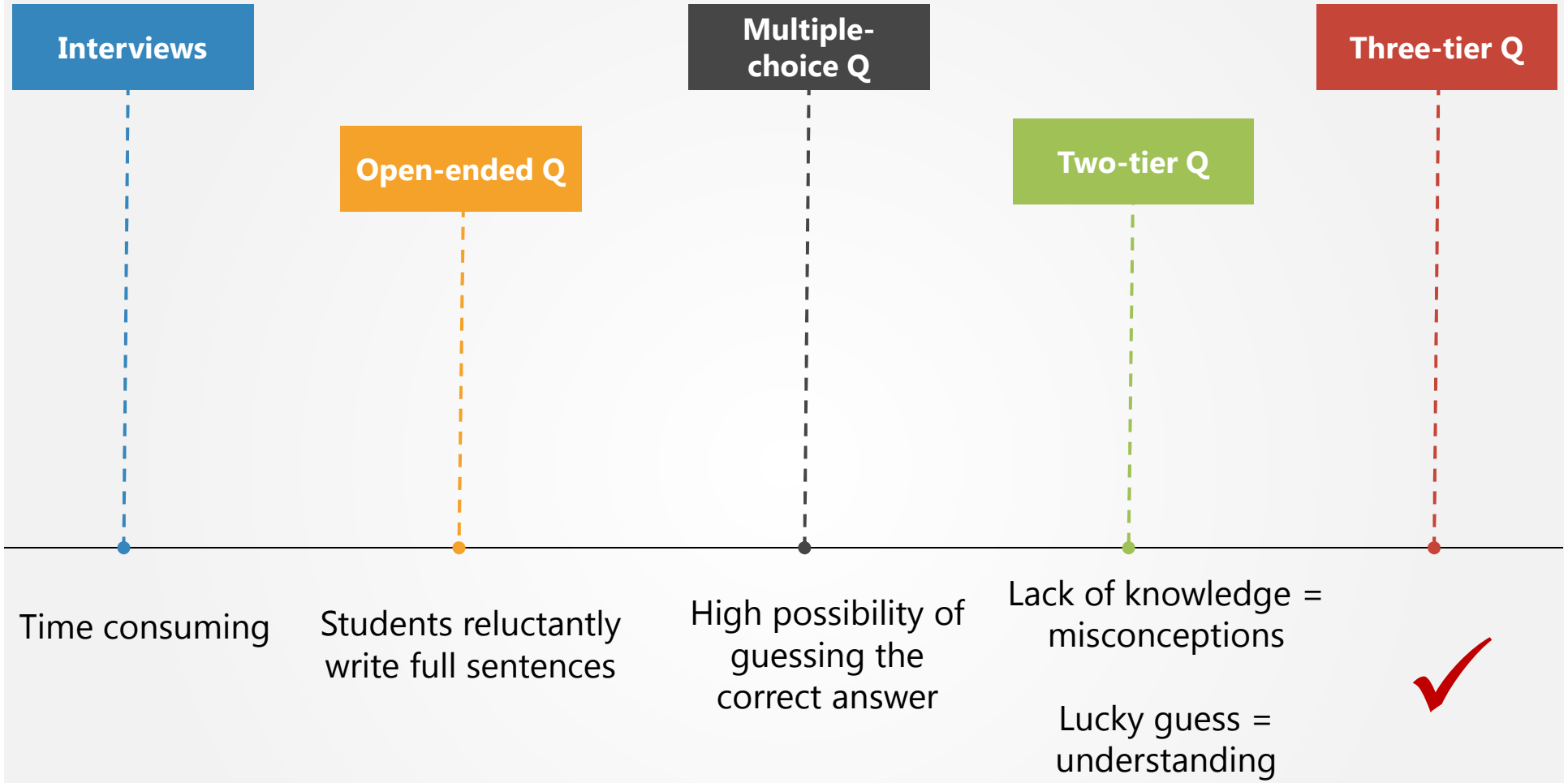

Interviews
Open-ended Q
Multiple-choice Q
Two-tier Q
Three-tier Q
Time consuming
Students reluctantly write full sentences
High possibility of guessing the correct answer
Lack of knowledge = misconceptions
Lucky guess = understanding

Research**Design**

Objectives

- Development of a three-tier instrument
- Validation of instrument
- Comparison of the effectiveness of 3-tier, 2-tier and common multiple choice test

Participants

- 40 students
- Secondary school, III grade: Technician for Industrial Pharmaceutical Technology
- 17-18 years old

Instrument

- 10 items
- Each item has 3 tiers:

  (i) Content tier,

  (ii) reasoning tier,

  (iii) confidence tier

Data**Interpretation**

SK	LG	M	LK
Scientific knowledge	**Lucky guess**	**Misconceptions**	**Lack of knowledge**
Correct, Correct, Yes	Correct, Correct, No	Correct, Incorrect, Yes Incorrect, Correct, Yes Incorrect, Incorrect, Yes	Correct, Incorrect, No Incorrect, Correct, No Incorrect, Incorrect, No

Assurance**Parameters**

Reliability

FT=0.629
BT=0.721
AT=0.826

Item difficulty

FT=0.51
BT=0.35
AT=0.22

Item discrimination

Ranging from: 0.15-0.77
Average 0.51 (excellent discrimination)

Validity

Content validity

%FP <10
%FN <10

Construct validity

r=0.58
p=0.00

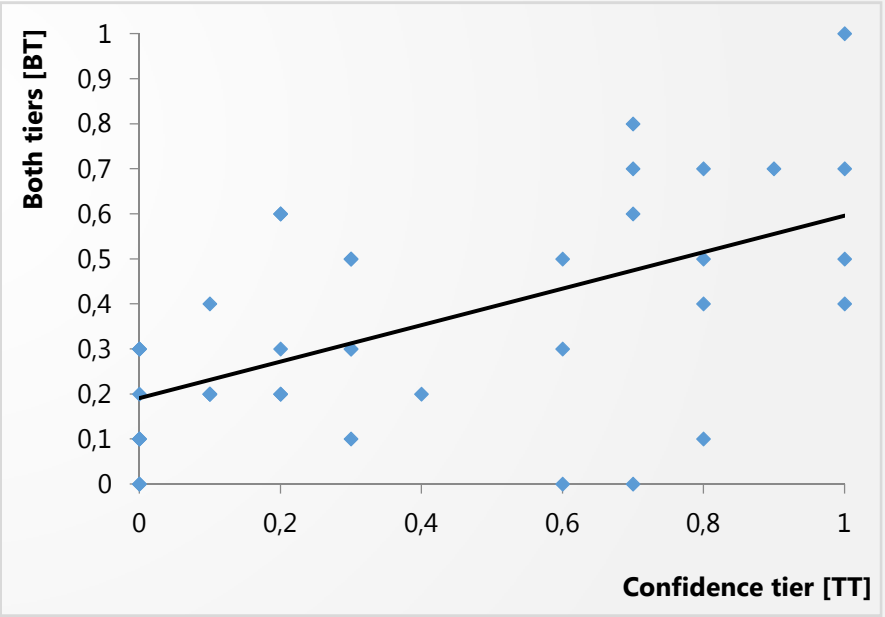


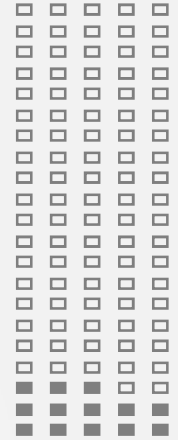
Figure 1. *Correlation between BT and TT scores*

Main**Statistics**

Q	SK	LG	LK	M
1	20.00	22.50	40.00	17.50
2	40.00	5.00	50.00	5.00
3	22.50	20.00	32.50	25.00
4	40.00	20.00	27.50	12.50
5	30.00	5.00	57.50	7.50
6	27.50	15.00	55.00	2.50
7	10.00	10.00	57.50	22.50
8	5.00	10.00	55.00	30.00
9	12.50	7.50	45.00	35.00
10	15.00	15.00	50.00	20.00
Mean	**22.25**	**13.00**	**47.00**	**17.75**

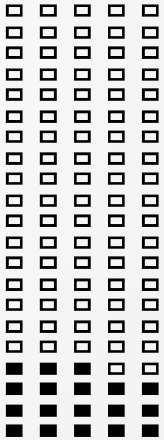
22%

Scientific knowledge



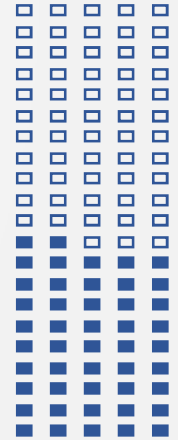
13%

Lucky guess



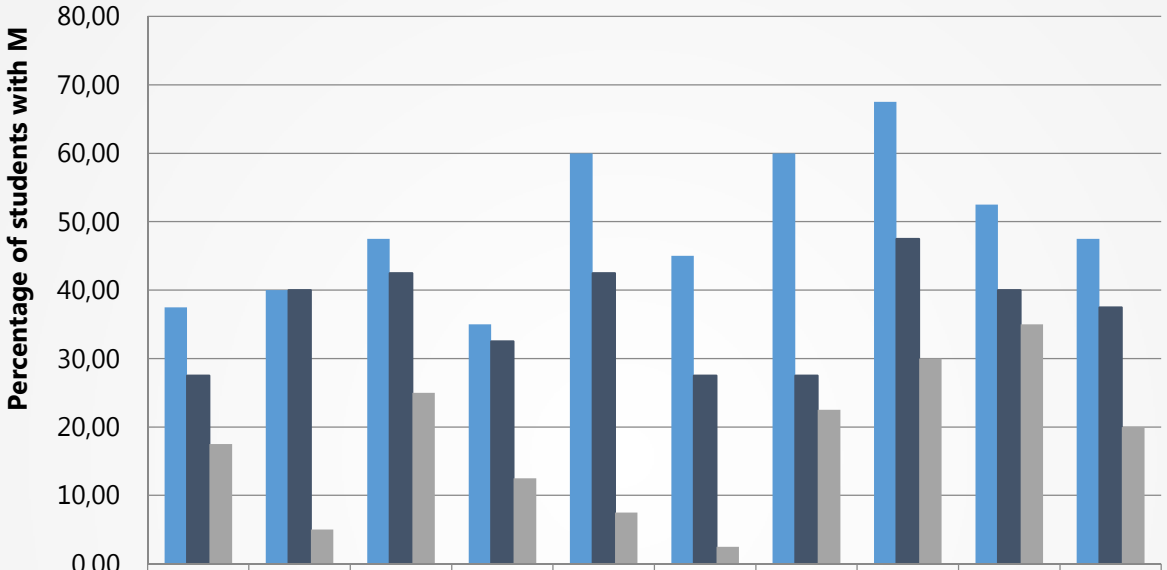
18%

Misconceptions



47%

Lack of knowledge



	1	2	3	4	5	6	7	8	9	10
M-FT	37,50	40,00	47,50	35,00	60,00	45,00	60,00	67,50	52,50	47,50
M-BT	27,50	40,00	42,50	32,50	42,50	27,50	27,50	47,50	40,00	37,50
M-AT	17,50	5,00	25,00	12,50	7,50	2,50	22,50	30,00	35,00	20,00

Figure 2. *Analysis of misconceptions by tiers*

Item**Example**

Item No. 8.

Circle the letter of the correct answer. Which of the following acids has the highest melting point?

a) Stearic acid
b) Linolenic acid
c) Butyric acid
d) Oleic acid

The reason for your answer is:

a) Molecules of the selected acid contain the largest number of carbon-carbon double bonds, which makes them very rigid.
b) Molecules of the selected acid contain the smallest number of carbon atoms, and therefore they are densely packed.
c) Each molecule of the selected acid contain only one carbon-carbon double bond, allowing them to stack together efficiently.
d) Molecules of the selected acid are long chains with no carbon-carbon double bonds and due to their spatial orientation there are the strongest Van der Waals forces between them.

Are you sure of your answers?

a) Yes
b) No

Conclusions and **Limitations**

- Designed three-tier test is a valid and reliable instrument for identification of misconceptions.
- Designed three-tier test provides better results in comparison to two-tier and common multiple-choice tests.

- Significance:
  (i) three-tier test is applied on chemistry contents

- Limitation:
  Students evaluate certainity in answers given in the first and second tiers simultaneously.

Thank**You**

dusica.milenkovic@dh.uns.ac.rs