Proving what is thought – The efficacy of MCQs

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Proving what is thought –
The efficacy of MCQs

https://community.computingatschool.org.uk/resources/4382
Efficacy of MCQs - overview

Quantum Project
x4 MCQs - good or bad
computational thinking ???
how do we know?

Item Response Theory
N = 755
then comparing with other measures
developing conclusions…
Each symbol is represented by a certain number. Identify the correct combination of numbers to represent:

- £ £ $ £
- $ $ $ £

Options:

A: 5 5 3
   3 1 3
   3 1 5

B: 5 5 1
   1 3 1
   3 1 5

C: 5 3 1
   1 3 1
   3 5 1

D: 5 5 1
   1 3 1
   5 1 3
MCQ#2

Each letter is represented by a certain number. Identify the word with no matching number.

ESTI 1510
OYLA 4982
AYAN 7531
AYNA 9102
SANI

Options:
A ESTI
B AYNA
C SANI
D OYLA
MCQ#3

Which of the followings is similar to the one given above?

A  

B  

C  

D
A, B, C and D are cogs and are interconnected.
1) When A turns clockwise, so does C.
2) C is joined to B.
3) D turns opposite to A.
Identify the true statement, when D turns clockwise?

- C turns clockwise, A turns anticlockwise.
- C turns anticlockwise, B turns clockwise.
- C and B turn anticlockwise.
- A and B turn anticlockwise.
Each symbol is represented by a certain number. Identify the correct combination of numbers to represent the symbol.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5 5 3 3 3</td>
</tr>
<tr>
<td>B</td>
<td>5 5 1 1 3</td>
</tr>
<tr>
<td>C</td>
<td>5 3 1 3 1</td>
</tr>
<tr>
<td>D</td>
<td>5 5 1 1 3</td>
</tr>
</tbody>
</table>

Item Characteristic Curves

B
Each letter is represented by a certain number. Identify the word with no matching number.
MCQ#3 X1

Which of the followings is similar to the one given above?

A

B

C

D

Item Characteristic Curves
MCQ#4 X9

A, B, C and D are cogs and are interconnected.
1) When A turns clockwise, so does C.
2) C is joined to B.
3) D turns opposite to A.
Identify the true statement, when D turns clockwise?

A. C turns clockwise, A turns anticlockwise.
B. C turns anticlockwise, B turns clockwise.
C. C and B turn anticlockwise.
D. A and B turn anticlockwise.

Item Characteristic Curves
What is IRT?

- Item Response Theory
- Analysis paradigm
- Relationship between item performance and general performance level of the individual
- Uses probability

“Item Response Theory (IRT) is a paradigm for the design analysis and scoring of test instruments that measures attitudes, abilities and other variables. This theory is based on the relationship between person’s performance on a test item and the person’s performance level on an overall measure of the ability the item was constructed to measure. IRT is based on a mathematical model, which describes in probabilistic terms, how a test taking person with a higher standing on a trait is likely to respond in a different response category to a person with a low standing on the trait (Ostini & Nering, 2006). IRT has several advantages over traditional test theory, such as, sample independency, measurement of range of different abilities, accounting item difficulty, accounting for guessing, and supporting adaptive testing (Thissen & Wainer, 2001).”


Overall study

- The full study investigates the relationship between computational thinking performance and general school achievement and explores if computational thinking performance can be predicted by algebra and informatics achievement.
- N = 775 grade 8 students from 28 secondary schools across Kazakhstan
- Computational Thinking Performance test of 50 multiple-choice questions (Project Quantum Diagnostic Questions Eedi platform)
- Computational Thinking Scale questionnaire
- Test: logical thinking, generalisation and abstraction
- Questionnaire: creativity, algorithmic thinking, cooperation, critical thinking and problem solving
- Secondary data: school achievement results across a number of school subjects
Computational thinking questionnaire

I like people who are very sure of their decisions.
I have the belief that I can solve the problems that may arise when I encounter a new situation.
When I plan to solve a problem, I am confident that I can carry out the plan.
When I face a problem, before I move on to another topic, I think about the problem.
I can immediately start the equation to solve a problem.
I think that it is easier to learn the expressions made with the aid of mathematical symbols and concepts.
I cannot apply the solutions I have designed in a gradual manner.
I cannot produce too many options when thinking about possible solutions to a problem.
I cannot develop my own thinking in a collaborative learning environment.
It makes me tired of trying to teach my group friends something in a collaborative learning environment.

Extract from
Preliminary results…

Computational Thinking Performance test showed a high degree of reliability.

- 3 questions were rated poor in terms of efficacy
- Internal consistency of results was high
- Comparative consistency of results was high

Algebra and general school achievement was a significant predictor of computational thinking performance.

Students’ perception of their computational thinking skills had a significant correlation with their computational thinking performance.

*No gender difference noted* in computational thinking performance and perceptions of computational thinking.