NATIONAL RESEARCH UNIVERSITY

Institute of Education

# MEASURING DIGITAL LITERACY: EVIDENCE FOR THE VALIDITY OF A CONCEPTUAL FRAMEWORK

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# DIGITAL LITERACY IN THE MODERN WORLD

Imagine the modern world without digital tools and devices. Is it even possible?

Since school age, digital literacy has become an increasingly relevant competency. Digital technologies affect the processes of learning and teaching and also make significant changes in the labour market.

**Measuring and assessing DL: a shortage of assessment systems**

# NEW ASSESSMENT SYSTEM

Most of DL conceptual frameworks focused on technical skills: how people interact with devices, manipulate elements of most common digital tools including shortcuts, hotkeys, etc.

*Sparks, Katz, Beile, 2016; Kim, Kil, Shin, 2014*

DL might be considered in a broad sense. DL might also represent cognitive skills in digital environment.

*e.g. Fraillon et al., 2014*

No tools are available to measure DL of Russian-speaking students, so we developed our own instrument following the evidence-centered design approach (ECD)

*Mislevy, Almond, Lukas, 2003*

Secondary school students: 14-16 years old.

# AIM

Provide evidence supporting the validity of our new DL conceptual framework.

## WHAT HAS BEEN DONE

- New conceptual framework based on the systematic literature review
- New assessment instrument: scenario-based assessment
- Psychometric properties of the assessment system

# CONCEPTUAL FRAMEWORK OF DIGITAL LITERACY

- Search and Analysis (of information)
- Create
- Information security and legal aspects of working with information
- Ethics and norms of communication

*Carretero et al., 2017; Chetty et al., 2018; Fraillon et al., 2014; Sparks et al., 2016*

# CONCEPTUAL FRAMEWORK OF DIGITAL LITERACY

## Search and Analysis (of information)

Search: strategies for collecting information in a digital environment.

Analysis: evaluating the quality of information (relevance, reliability, fullness or redundancy)

- Create
- Information security and legal aspects of working with information
- Ethics and norms of communication

*Carretero et al., 2017; Chetty et al., 2018; Fraillon et al., 2014; Sparks et al., 2016*

# CONCEPTUAL FRAMEWORK OF DIGITAL LITERACY

- Search and Analysis (of information)

## Create

Quality of the content constructed within the digital environment (article, infographics, email, etc.) and implies the usage of different sources of information.

- Information security and legal aspects of working with information
- Ethics and norms of communication

*Carretero et al., 2017; Chetty et al., 2018; Fraillon et al., 2014; Sparks et al., 2016*

# CONCEPTUAL FRAMEWORK OF DIGITAL LITERACY

- Search and Analysis (of information)
- Create

## Information security and legal aspects of working with information

Knowledge and compliance with practices of safe work in a digital environment (confidentiality, integrity, destruction of information), taking into account legal norms.

- Ethics and norms of communication

*Carretero et al., 2017; Chetty et al., 2018; Fraillon et al., 2014; Sparks et al., 2016*

# CONCEPTUAL FRAMEWORK OF DIGITAL LITERACY

- Search and Analysis (of information)
- Create
- Information security and legal aspects of working with information

## Ethics and norms of communication

communication skills used in compliance with the norms and rules of network etiquette (a student communicates respectfully and politely with interlocutors).

*Carretero et al., 2017; Chetty et al., 2018; Fraillon et al., 2014; Sparks et al., 2016*

# CONCEPTUAL FRAMEWORK OF DIGITAL LITERACY

- Search and Analysis (of information)
- Create
- Information security and legal aspects of working with information
- Ethics and norms of communication

## Technical skills

a skill set desirable to manipulate elements of most common digital tools

*Carretero et al., 2017; Chetty et al., 2018; Fraillon et al., 2014; Sparks et al., 2016*

# INSTRUMENT

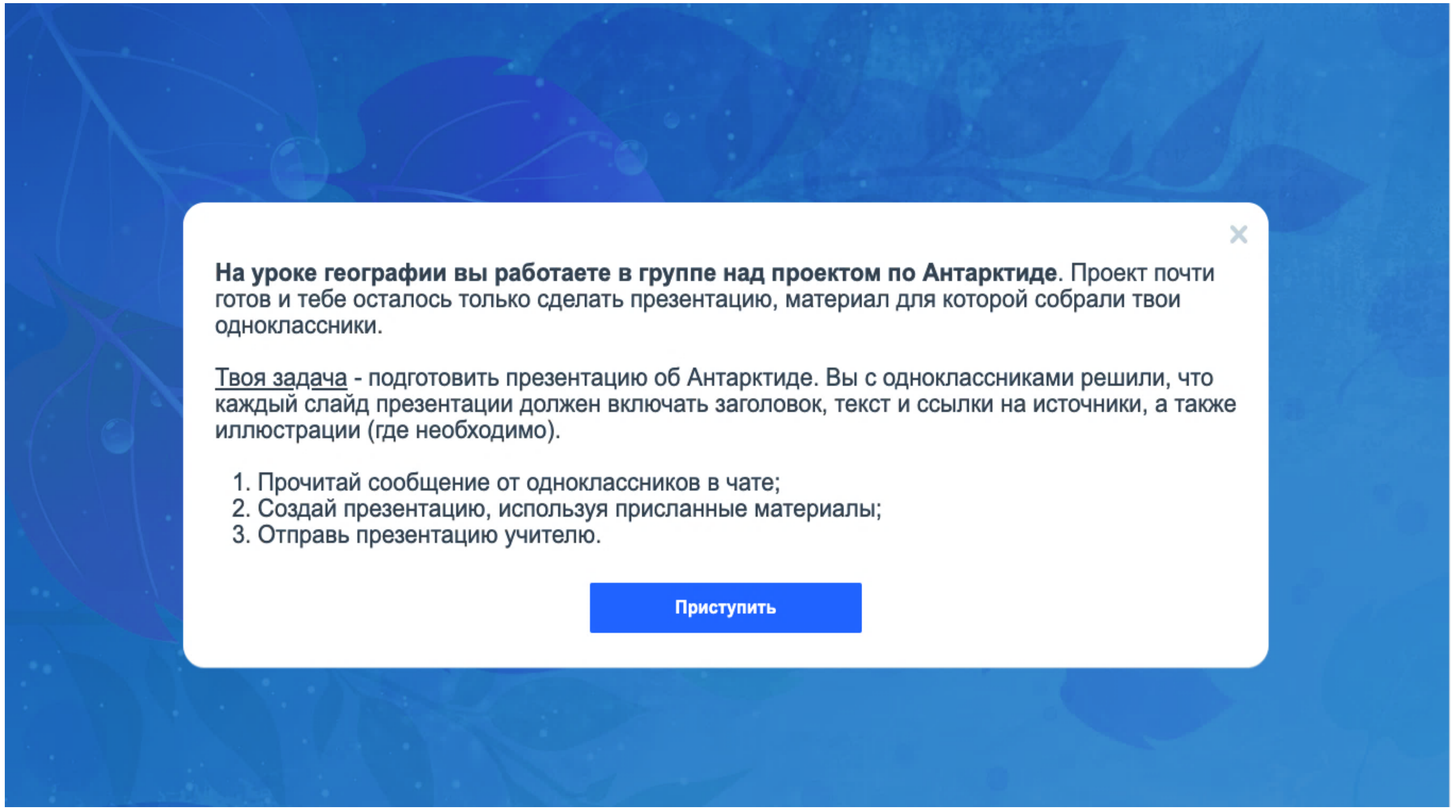
**5** scenarios that simulate familiar to adolescents contexts of the digital environment.

Students faced the necessity to use an internet browser, email, chat or presentation making platform in learning and every-day life situations.

Each scenario includes several hidden indicators each related to 5 targeted constructs.

Initially, about 60 indicators were developed. During the preliminarily analysis several items have been excluded  or combined.

# INSTRUMENT: AN EXAMPLE “ANTARCTICA”



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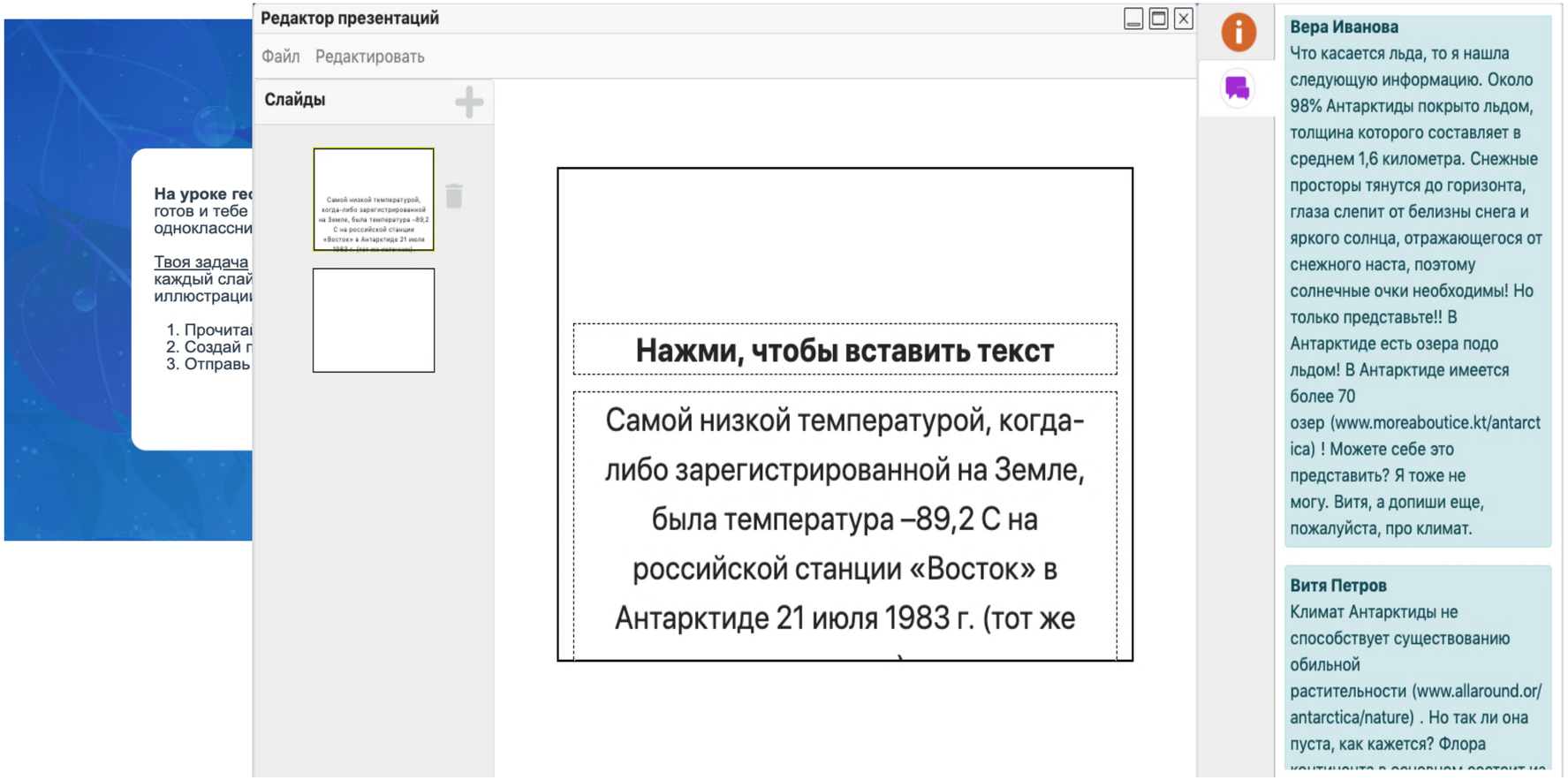

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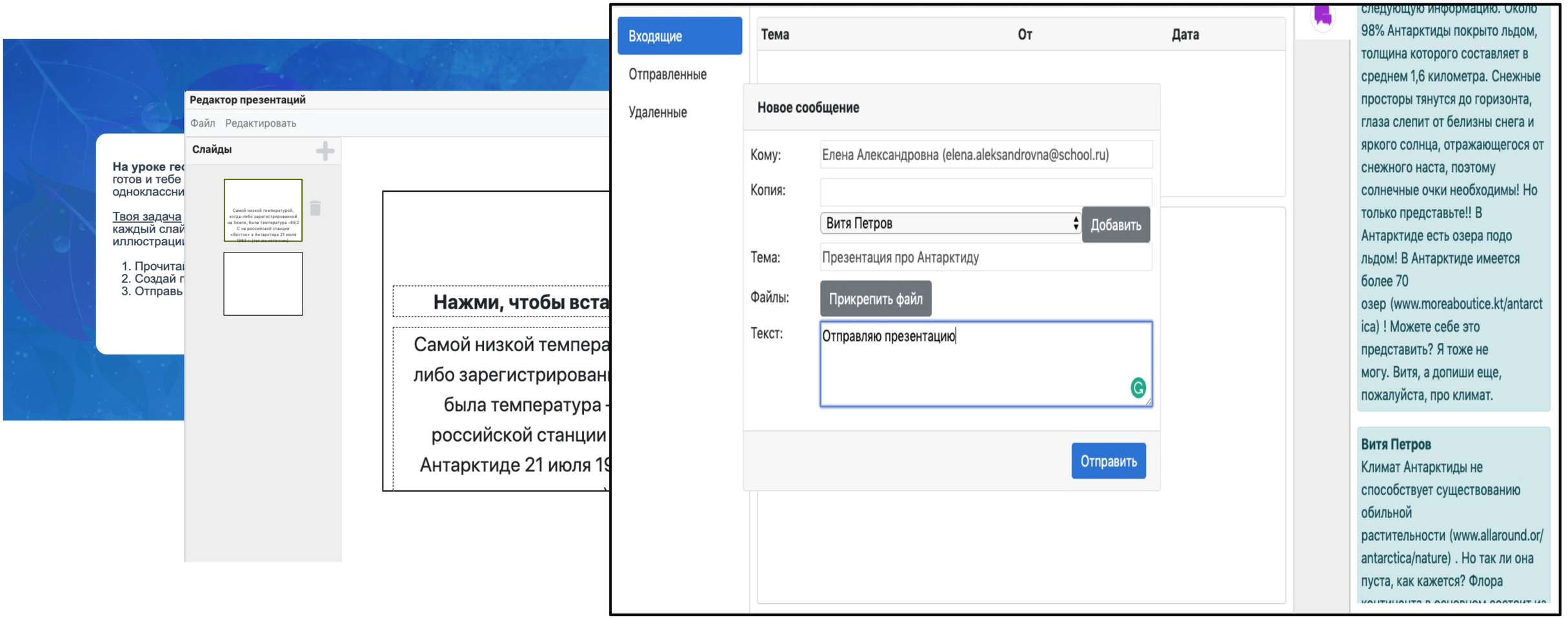


# PARTICIPANTS AND PROCEDURE

940 9-grade adolescents from 11 schools located in a big city in the central district of Russia.

mean age = 14,7 (SD = 0,46), 50,1% female

Testing time – 45 minutes.

The scenarios were presented in a random sequence.

Some of the scenarios were not presented to 6.5% of students due to technical issues. Following quantitative analysis was based on a sample of **879** students.

# STATISTICAL ANALYSIS

Rasch modeling (Item response theory, IRT; *Hambleton, Swaminathan, & Rogers, 1991*)

1. **Preliminary analysis:** the investigation of local independence violation

common context = common scenario

related by the common context indicators have been grouped into bundles (Rosenbaum, 1988)

bundles were analyzed as polytomous items (Quellmalz, Timms, Silberglitt, & Buckley, 2012)

2. **Dimensionality analysis:** looking towards the general factor of DL

Compare

a) model assumed correlated factors (Adams, Wilson, & Wang, 1997)

b) model assumed one general factor and four uncorrelated factors (testlet model; Wang & Wilson, 2005)

# RESULTS: PRELIMINARILY ANALYSIS

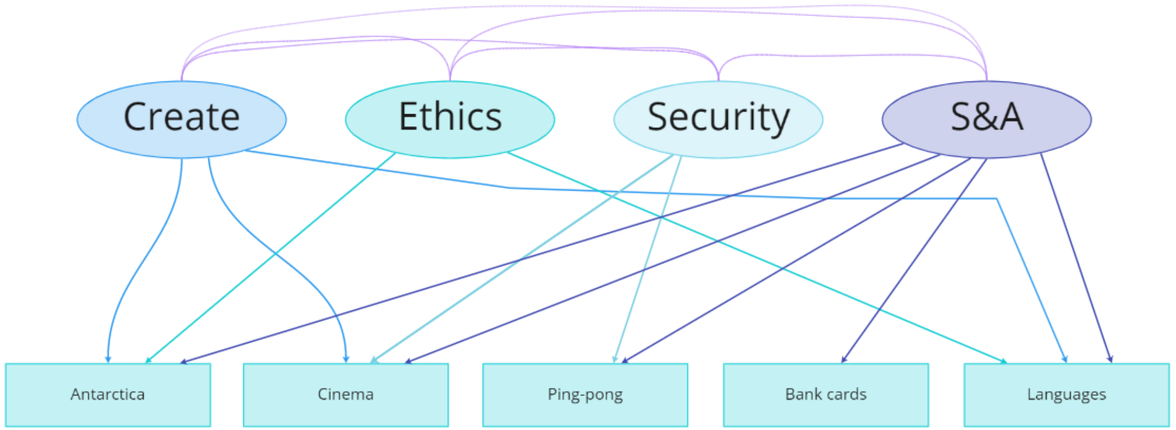
4 item-bundles from 2 to 4 indicators.
INFIT MNSQ varied from 0.8 to 1.2
Each scale might be considered as substantially unidimensional.

EXEPTION: indicators potentially represented **Technical skills** has not form one holistic factor.

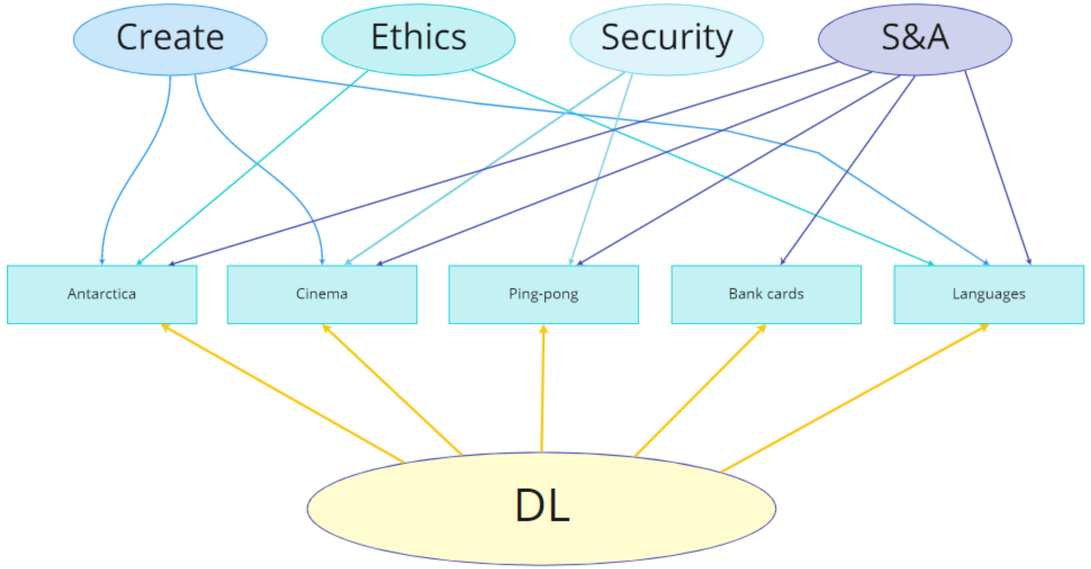
Overall, 33 indicators for 4 scales for 5 scenarios.

| | Create | Ethics and norms of communication | Information security and legal aspects of working with information | Search and Analysis |
|---|---|---|---|---|
| Antarctica | 1 | 3 | - | 1 |
| Cinema | 1 | - | 2 | 2 |
| Ping-pong | - | - | 3 | 4 |
| Bank cards | - | - | - | 4 |
| Languages | 6 | 1 | - | 5 |

# RESULTS: DIMENSIONALITY ANALYSIS

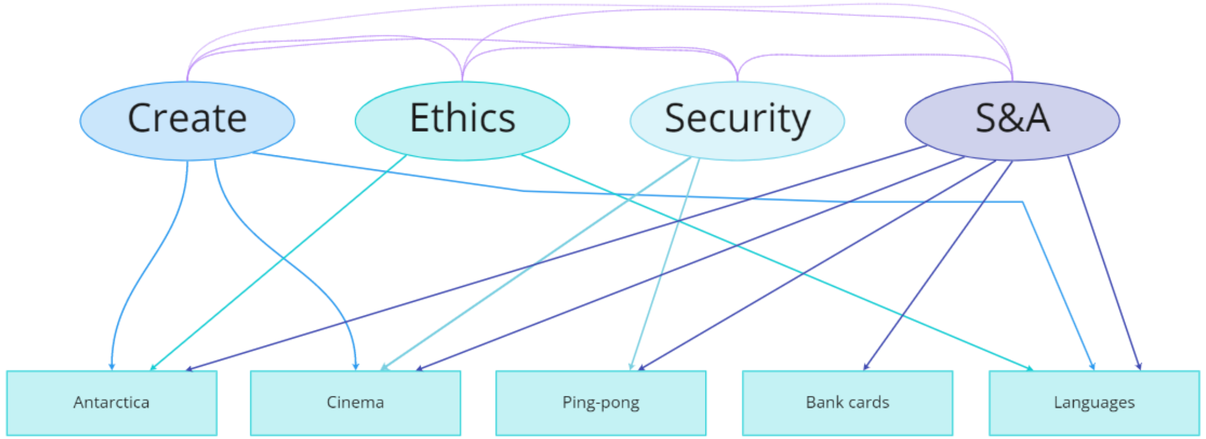



Correlated factor model




Testlet model

# RESULTS: DIMENSIONALITY ANALYSIS




| | Correlated factor model | Testlet model |
|---|---|---|
| AIC | 39282 | 39374 |
| BIC | 39583 | 39651 |
| AICΔ = 102.93; BICΔ = 79.03 | | |

DL should not be interpreted as a holistic construct but only as a general name of several related skills.

# RESULTS: PSYCHOMETRIC PROPERTIES

| | Number of indicators | Average difficulty (SD) | Average standard error (SD) | Average INFIT MNSQ (SD) | Reliability |
|---|---|---|---|---|---|
| Create | 8 | -0,32 (0,46) | 0,07 (0,02) | 0,98 (0,08) | 0,66 |
| Ethics and norms of communication | 4 | 1,29 (0,66) | 0,07 (0,01) | 1,00 (0,04) | 0,55 |
| Information security and legal aspects | 5 | 0,57 (1,21) | 0,09 (0,01) | 0,99 (0,09) | 0,65 |
| Search and Analysis | 16 | -0,25 (0,75) | 0,06 (0,02) | 1,01 (0,06) | 0,75 |

# DISCUSSION AND CONCLUSION

- The structural validity was partially confirmed: four correlated factors describing DL.
- Most of the indicators represent target components.
- Indicators that were expected to represent Technical skills component do not form one holistic factor.
- DL should not be interpreted as a holistic construct but only as a general name of several related skills.

**The instrument has satisfactory psychometric properties,**
**however, some improvements are needed**

## FUTURE DIRECTION

Qualitative study to check the content validity of the scenarios from the students' point of view.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