University of Latvia, Faculty of Computing

- Study programmes: **B., M., PhD.**
- FoC students: ~830 in total
- Language: **Latvian** (rarely: English)
- M.’s study programme: **Comp. Science, SE, IT, IS, Comp. Engineering**

- **Prof. Andris Ambainis** (LV / USA)
- Field of research: **quantum computing & information theory**
- Speaker at TEDxRiga
My Job at the University of Latvia

**Faculty of Computing**

**Assist. Professor**
- Software Requirements Analysis
- Databases: Introduction
- Seminar on Opinion Mining

**Researcher**
- Requirement Analysis
- BI / DWH / Big Data
- E-learning

**ICT Services**

**Sr. Systems Analyst**
- Requirement Elicitation
- Development & Maintenance of IS Modules
- BI Reporting
- End-User Training
- etc.
PART I

EXTENDING A METAMODEL FOR FORMALIZATION OF DATA WAREHOUSE REQUIREMENTS
Introduction

• We focus our research on applying demand-driven (more precisely, user-driven) methodology to construct a DW conceptual model

• We interpret DW information requirements as indicators

• **Indicator definition** from BABOK® Guide: An **indicator** identifies a specific numerical measurement for a goal, impact, output, activity, or input. Each factor of interest has at least one indicator to measure it properly, but some may require several.
Background and Questions of Interest

Current Situation

• DW of the University of Latvia accumulates data to reflect diverse indicators
  • Student enrolment, strategic indicators, staff workload, user activity in CMS, etc.
• Regular demand from client’s side for DW reports
  • Over 150 reports and growing
• High interest in dashboards

Questions

• How to structure and systematize DW information requirements?
• Which reports and schema elements to incorporate into dashboards?
Deriving a Conceptual Model of a DW from Information Requirements
Requirement Formalization Metamodel

Initial version of the metamodel

Based on over **330 indicators** from business field

- Measurement perspectives: customer focus, environment & community, employee satisfaction, finance, internal process, and learning & growth
- **Source:** Indicator database from “Key Performance Indicators: Developing, Implementing, and Using Winning KPIs” by Parmenter, D. (2010)

Extended version of the metamodel

Based on over **150 indicators** from the real DW project of the University of Latvia

- Indicator groups: student enrolment, strategic indicators, staff workload, user activity in CMS, staff/student publications, etc.
- **Source:** Indicators for existing reports developed with MicroStrategy tools
Case Study & Findings

• We analyzed sentences that express indicators in natural language with an aim to discover common patterns

• **Initial version of the metamodel:**
  A set of principles was worked out that serves to translate the informal requirements in natural language to a state that is compatible with the requirement formalization metamodel

  \[
  \text{calls} \rightarrow \text{count (call)}, \; \text{number of visits} \rightarrow \text{count (visit)}, \\
  \text{listing of customers} \rightarrow \text{show customers}, \; \text{total income} \rightarrow \text{sum (income)}, \; \text{etc.}
  \]

• **Extended version of the metamodel:**
  Indicators were reformulated according to the above-mentioned principles, and checked for compliance with the initial metamodel

  Around 14% of indicators did not comply

• As a result, new classes and relationships between classes were added to the requirement formalization metamodel
Requirement Formalization Metamodel

- **Requirement**
  - isObsolete : Boolean
  - isUnprocessed : Boolean

- **Complex Requirement**
  - Theme
    - name : string

- **Group**
  - name : string

- **Typified Condition**
  - Condition Type
    - value = "where"

- **Complex Condition**
  - Logical Operator
    - value = "or", "and", "not"

- **Simple Condition**
  - Expression
    - Simple Expression
      - Constant
      - Qualifying Data
        - name : string
      - Refinement
        - value = "show"
  - Comparison
    - value = "must", "should", "could", "won't"

- **Operation**
  - Aggregation
    - value = "count", "sum", "average", ..."

- **Complex Operation**
  - Action
    - Priority
      - value = "highest", "high", "medium", "low", "lowest"

- **Object**
  - Quantifying Data
    - name : string

- **1..* 1**

- **Business Process**
  - name : string
An Example of a Formalized Indicator

• **An indicator in natural language:** “The ratio of master level graduates in the University of Latvia in 2016, who are employers, has to be 10% of master level graduates in the University of Latvia in 2015”

• **A formalized indicator:**
  
  “((count (graduate) where level='master' and year='2016' and status='employer') / (count (graduate) where level='master' and year='2016')) = (10% * (count (graduate) where level='master' and year='2015'))”

• If there are such components as “%”, “percent”, “percentage”, or “ratio”, then it is substituted by **division of partial quantity by total quantity**

• A component to be measured is treated as an aggregated number of all its occurrences: “graduates” → “count (graduate)”

• “Has to” was interpreted as a request for equality → “=” sign

• “10%” is a **simple requirement** that consists of a single constant value

• Now it is possible also to **evaluate the ratio** (e.g. “has to be 10% …”)


Prioritization Technique

• Existing prioritization techniques: Top-10 Requirements, Ranking, Numerical Assignment (Grouping), 100-Dollar Test, MoSCoW Analysis, etc.

• Preferred approach – **MoSCoW Analysis**
  • A fast and straightforward approach with precisely defined priority values
  • Doesn’t require complex calculations during re-prioritisation process
  • Suitable for a small group of decision-makers

• **Priority values** in MoSCoW (from BABOK® Guide)
  • **“Must”**: *must be satisfied* in the final solution for it to be considered a success
  • **“Should”**: *should be included* in the solution if it is possible
  • **“Could”**: *desirable* but not necessary
  • **“Won’t”**: will not be implemented in a given release, but *may be considered*
How requirement priority values are propagated to pre-schema elements?

- A pre-schema generation algorithm (PGA) can map elements of formalized requirements to DW schema elements.
- If a schema element (e.g. a Study Program attribute) has multiple priority values (e.g. must, could), then the one with the higher value is assigned (i.e. must).
Which elements of the accepted pre-schema to incorporate into dashboards?

- Detect **schema elements with highest priorities**
- Check if any of these elements build up **data hierarchies**

Examples of formalized requirements (with high priorities):

- **R1**: show **course** count (user session occurrence) where user role = “student”
- **R2**: show **course category** count (user session occurrence) where user role = “student”
- **R1 → R2** is a requirement hierarchy example, because schema elements form a hierarchy **Course → Course Category**

- A dashboard report would include the **R2** requirement
Dashboard Example
Summary

• A case study was conducted to test the existing requirement formalization metamodel on a set of over 150 indicators for a real currently operating DW project of the University of Latvia.

• Due to a specific structure of requirements that contain an evaluation of ratios, the metamodel had to be restructured and extended with some additional classes like themes, grouping, business processes, stakeholders, and requirement priorities.

• MoSCoW analysis was chosen as the most suitable requirement prioritization technique.

• Application of priorities was discussed in the context of dashboard and report development.
Details on Technical Implementation of iReq

iReq as a GUI for formalized requirement input

- A web-based tool with responsive design
- iReq is written in **PHP** (Laravel framework)
- Requirement input: **HTML, CSS, JavaScript** (Bootstrap, jQuery libraries)
- Data are stored in **MariaDB**
- **Neo4j** for graphs
An Example of Glossary as Graph DB

Source DB structure → .CSV → Neo4j Graph DB
### A Requirement Example in iReq Tool

- An example requirement from the Strategic Plan (2010-2020)
- “Show information on student and academic staff ratio”

<table>
<thead>
<tr>
<th>Group</th>
<th>Theme</th>
<th>Stakeholder</th>
<th>Business process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic Plan 2010-2020</td>
<td>Studies</td>
<td>Senate</td>
<td>Study process</td>
</tr>
</tbody>
</table>

---

### Complex Requirement

<table>
<thead>
<tr>
<th>Simple Requirement</th>
<th>Arithmetical Operator</th>
<th>Simple Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action</td>
<td>Object</td>
<td>Operation</td>
</tr>
<tr>
<td>Aggregation count</td>
<td>Quantifying Data</td>
<td></td>
</tr>
<tr>
<td>student</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

### Typified Condition

<table>
<thead>
<tr>
<th>Condition Type</th>
<th>Where</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple Condition</td>
<td></td>
</tr>
<tr>
<td>Qualifying Data</td>
<td>employee_group</td>
</tr>
<tr>
<td>Comparison</td>
<td>=</td>
</tr>
<tr>
<td>Constant</td>
<td>academic staff</td>
</tr>
</tbody>
</table>

---

**Note:** The diagram illustrates the structure of a requirement in the iReq tool, showing how different components can be combined to form a requirement.
Another Example in iReq Tool

- An example requirement from the Student Council
- “Show information on students from Riga that attend lectures held in Latvian”
ER Model of iReq Requirements Repository

- Table `classes` stores data on all the elements of requirements
- `classes.type` - Action, Simple Condition, Quantifying data, etc.
Future Work for iReq GUI

• Perform **more GUI testing** of the iReq tool to improve it (e.g. add informal description of requirements)

• Provide an option for entering formalized requirements manually as **input expressions** in order to parse and **save(retrieve) them into(from) a database** correctly

• Make collected requirements fully or partially **reusable**
END OF PART I

Thank you! Questions?
PART II

AN EMPIRICAL STUDY OF RECOMMENDATIONS IN OLAP REPORTING TOOL
# Recommendation Modes: A Summary

<table>
<thead>
<tr>
<th>Recommendation Mode</th>
<th>How is the report similarity detected?</th>
<th>How user preferences are obtained?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report Structure Mode</td>
<td><img src="REPORT.png" alt="Report Structure" /></td>
<td>Implicitly (analysis of the report structure)</td>
</tr>
<tr>
<td>User Activity Mode</td>
<td><img src="REPORT.png" alt="Report Structure" /> <img src="USER.png" alt="User Activity" /></td>
<td>Implicitly (analysis of the user activity history)</td>
</tr>
<tr>
<td>Semantic Mode</td>
<td><img src="REPORT.png" alt="Report Structure" /> <img src="PROFILE.png" alt="User Profile" /></td>
<td>Explicitly (analysis of the user profile)</td>
</tr>
</tbody>
</table>
Metadata Layers in the Reporting Tool

All operation of the data warehouse framework and the OLAP reporting tool as a part of it is based on metadata that consists of **five interconnected layers**.
Semantic Mode: An Example of the User Profile

Choose semantic terms from a glossary:

Assign the DOI to each of the terms:

<table>
<thead>
<tr>
<th>Glossary</th>
<th>Concept</th>
<th>Term</th>
<th>Degree of Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laiks</td>
<td>Mēness</td>
<td>Mēness</td>
<td>55</td>
</tr>
<tr>
<td>Studiju process</td>
<td>Ārzemnieks</td>
<td>Ārzemnieks</td>
<td>95</td>
</tr>
<tr>
<td>Vērtēšanas process</td>
<td>Vērtējumu skaits</td>
<td>Vērtējumu skaits</td>
<td>75</td>
</tr>
</tbody>
</table>
## Semantic Mode: Recommendations Example

### Vērtējumu grāmata - Gala un starpvērtējumu vērtības

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Recommendation by Semantic Meaning</th>
<th>Similarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vērtējumu grāmata - Gala un starpvērtējumi. Gala vērtējumu skaits mēnesī pa kursiem ārzemniekiem</td>
<td>0.247; 0.183</td>
</tr>
<tr>
<td>2</td>
<td>Vērtējumu grāmata - Gala un starpvērtējumi. Starpvērtējumu skaits mēnesī pa kursiem ārzemniekiem</td>
<td>0.247; 0.183</td>
</tr>
<tr>
<td>3</td>
<td>Vērtējumu grāmata - Gala un starpvērtējumu vērtības. Gala vērtējumu vērtības pa kursiem ārzemniekiem</td>
<td>0.183; 0.183</td>
</tr>
<tr>
<td>4</td>
<td>Vērtējumu grāmata - Gala un starpvērtējumu vērtības. Starpvērtējumu vērtības pa kursiem ārzemniekiem</td>
<td>0.183; 0.183</td>
</tr>
<tr>
<td>5</td>
<td>Studentu sadalījums pa dzimumiem. Studentu dzimumi fakultātēs pa studiju veidiem - ārzemnieki</td>
<td>0.164; 0.000</td>
</tr>
<tr>
<td>6</td>
<td>Studentu sadalījums pa dzimumiem. Studentu dzimumi pa studiju veidiem un tem. jomām - ārzemnieki</td>
<td>0.164; 0.000</td>
</tr>
<tr>
<td>7</td>
<td>Atjaunojušies un 1. kursa atbīrams. Atjaunojušies - ārzemnieki</td>
<td>0.158; 0.000</td>
</tr>
<tr>
<td>8</td>
<td>Atskaitītie studenti. Studentu atbīrams pa fakultātēm un izglītības līmeniem - ārzemnieki</td>
<td>0.158; 0.000</td>
</tr>
<tr>
<td>9</td>
<td>Studentu skaits uz 1. datumu. Studējošo skaits pa izglītības līmeniem un programmām - ārzemnieki</td>
<td>0.158; 0.000</td>
</tr>
<tr>
<td>10</td>
<td>Vērtējumu grāmata - Vērtējumu skaits. Kopējais vērtējumu skaits mēnesī pa kursiem</td>
<td>0.138; 0.183</td>
</tr>
</tbody>
</table>
Goal and Limitations of the Study

Goal
Analyze report recommendation modes implemented in OLAP reporting tool for the purpose of evaluation with respect to their performance from the point of view of the researcher in the context of laboratory settings

Limitations
• Methods in each recommendation mode exploit OLAP schema metadata and aggregate functions
• Recommendations in the reporting tool are generated individually for each user
Participants

Individual meetings with 30 participants from the Faculty of Computing, IT and Academic department

• 3 user groups
  • Administrative staff (12 subjects) – monitor study process and make decisions on how to invest in it (e.g. department directors)
  • Academic staff (8 subjects) – participate in the study process and in content creating for Moodle CMS (e.g. lecturers, professors)
  • Students (10 subjects) – the main consumers of the Moodle CMS content
Context and Course of the Study

Context
• Reports on data about user interaction with Moodle course management system and study process
• Up to 70 reports available for each subject

Blocking
• On experience (i.e., novice/average/experienced)
• On rights (i.e., students_academic staff/administrative staff)

Conducting the Experiment
• Quick demo of how to use the reporting tool and task handouts
• Survey after each task (16 questions) + free-form comments
• User clicks are collected in the log-table
Experimentation Tasks

4 Tasks of Equal Complexity

• 1 test task completed with no recommendations
• 3 tasks (1 in each mode) completed with recommendations
• Each task was considered to be finished, when a subject had completed all 4 subtasks
• Tasks are different in each group

A Subtask Example

Find a Moodle e-course category with the highest number of user sessions in the e-learning system. Session length varies from 10 to 60 min and user role is “Guest”.
Results of the Log-Table Analysis

Log-Table Analysis

- User clicks were analyzed to characterize how intensively the recommendation component was used.
- Precision/Recall and $F_1$-measure were used for analysis.
- In terms of the Mann-Whitney U test 3 pairwise comparisons of $F1$-measures acquired in each mode were made.

Results

<table>
<thead>
<tr>
<th>Mode №1</th>
<th>Mode №2</th>
<th>Comparison Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report Structure Mode</td>
<td>Semantic Mode</td>
<td>There is no significant difference in performance of the recommendation component</td>
</tr>
<tr>
<td>Report Structure Mode</td>
<td>User Activity Mode</td>
<td>The recommendation component in mode №1 outperforms that in mode №2</td>
</tr>
<tr>
<td>Semantic Mode</td>
<td>User Activity Mode</td>
<td>The recommendation component in mode №1 outperforms that in mode №2</td>
</tr>
</tbody>
</table>
How would you evaluate the complexity of the 1st/2nd/3rd task?

1st task in Report Structure Mode

2nd task in Semantic Mode

3rd task in User Activity Mode
Did the report recommendations help you complete the 1\textsuperscript{st}/2\textsuperscript{nd}/3\textsuperscript{rd} task?

### 1\textsuperscript{st} task in Report Structure Mode

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>Mostly yes</th>
<th>Mostly no</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative staff</td>
<td>36.67%</td>
<td>3.33%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Academic staff</td>
<td>13.33%</td>
<td>13.33%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Students</td>
<td>26.67%</td>
<td>6.67%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

### 2\textsuperscript{nd} task in Semantic Mode

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>Mostly yes</th>
<th>Mostly no</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative staff</td>
<td>26.67%</td>
<td>13.33%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Academic staff</td>
<td>13.33%</td>
<td>13.33%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Students</td>
<td>10.00%</td>
<td>23.33%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

### 3\textsuperscript{rd} task in User Activity Mode

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>Mostly yes</th>
<th>Mostly no</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative staff</td>
<td>13.33%</td>
<td>23.33%</td>
<td>3.33%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Academic staff</td>
<td>0.00%</td>
<td>10.00%</td>
<td>13.33%</td>
<td>3.33%</td>
</tr>
<tr>
<td>Students</td>
<td>0.00%</td>
<td>33.33%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
Was it easier to complete the tasks employing any of the recommendation modes (1\textsuperscript{st}-3\textsuperscript{rd} tasks) than to complete it without any recommendations (Test task)?

![Bar chart showing the comparison between completing tasks with and without recommendations for different groups.](image)

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>Mostly yes</th>
<th>Mostly no</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative staff</td>
<td>23.33%</td>
<td>16.67%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Academic staff</td>
<td>10.00%</td>
<td>16.67%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Students</td>
<td>20.00%</td>
<td>13.33%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
# Results of User Survey Analysis

<table>
<thead>
<tr>
<th>Recommendation Mode</th>
<th>Points</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report Structure Mode</td>
<td>9</td>
<td>More suitable for inexperienced users</td>
<td>Not stated</td>
</tr>
<tr>
<td>User Activity Mode</td>
<td>5</td>
<td><strong>Useful</strong> in everyday life, if one has to work with <strong>the same set</strong> of reports</td>
<td><strong>Hard</strong> to evaluate in just 1 session time</td>
</tr>
<tr>
<td>Semantic Mode</td>
<td>11</td>
<td>Received the most <strong>precise</strong> recommendations (regardless of the experience)</td>
<td>The task seemed <strong>harder than others</strong> because of the <strong>profile</strong> completion</td>
</tr>
</tbody>
</table>
Conclusions and Suggestions

The Main Conclusion on the Results of the Study

All of the recommendation modes were positively evaluated by users of different experience in terms of saving user effort and are helpful in completing exploratory tasks.

Suggestions to Consider

- **Improve usability** of the OLAP reporting tool
- **Integrate user feedback** to improve the quality of the received recommendations
- **Make** recommendation component a parametrized module that it would be compatible with other reporting tools
END OF PART II

Thank you! Questions?
Outline

Introduction
• Recommendation Modes: A Summary

An Empirical Study
• Goal and Limitations of the Study
• Participants
• Context and Course of the Study
• Experimentation Tasks

Results
• Results of the Log-Table Analysis
• Results of User Survey Analysis
• Conclusions and Suggestions
Logical Metadata
Physical Metadata

```
User
- Name : String
- Username : String
- Contacts : String
- Title : String

Table
- Name : String
- Owner : String

View
- Name : String
- Owner : String
- SQLText : String

Query
- Name : String
- SQLText : String

Column
- Name : String
- DataType : String
- Precision : Integer
- Scale : Integer
- IsNull : Boolean
- Length : Integer
- keyColumn {ordered}

Key
- IsPrimary : Boolean
- primaryKey

ColumnSet
- RefreshDate : Date

AccessRights
- Condition : String

Attribute
- (from Logical)

Measure
- (from Logical)

SchemaElement
- (from Logical)

Mapping
- Function : String

0..*
1..*
0..*
```

**Diagram Notes:**
- The diagram illustrates the relationships between different metadata elements, including users, tables, views, queries, columns, access rights, attributes, measures, schema elements, and mappings.
- Each element is represented with its associated attributes and relationships, indicating how they interact within the metadata framework.
- The diagram is designed to provide a clear visual representation of the logical and physical aspects of metadata in a database system.
Reporting Metadata
Semantic Metadata
OLAP Preferences Metadata

- SimpleOlapPreference
  - ComplexOlapPreference
- Schema-Specific
  - ComplexOlapPreference
  - SimpleOlapPreference
  - Workbook
    - Worksheet
- Report-Specific
  - ComplexOlapPreference
  - SimpleOlapPreference
  - Workbook
    - Worksheet
- SchemaElement
  - ComplexOlapPreference
  - SimpleOlapPreference
  - Workbook
    - Worksheet
- PreferenceElement
  - ComplexOlapPreference
  - SimpleOlapPreference
  - Workbook
    - Worksheet
- AcceptableAggregation
  - ComplexOlapPreference
  - SimpleOlapPreference
  - Workbook
    - Worksheet
- Item
  - ComplexOlapPreference
  - SimpleOlapPreference
  - Workbook
    - Worksheet
- Term
  - ComplexOlapPreference
  - SimpleOlapPreference
  - Workbook
    - Worksheet

- LogicalOperator
  - Value
- Condition
  - Name
- Expression
  - Value
- SimpleCondition
  - Value
- ComplexCondition
  - Value

- DegreeOfInterest

- from Logical

- from Reporting
# Results of the Log-Table Analysis

| TP | Precision (P) | $P = \frac{TP}{TP + FP}$ |
| FP | Recall (R)    | $R = \frac{TP}{TP + FN}$ |
| FN | $F_1$-measure | $F_1 = \frac{2 \times P \times R}{P + R}$ |

TP - The number of relevant reports that the user examined by means of hitting the link in the recommendation component

FP - The number of irrelevant reports in the recommendation component

FN - The number of relevant reports that the user examined not following the recommendation link

In terms of **Mann-Whitney U** test 3 pairwise comparisons of **$F_1$-measures** acquired in each mode were made.

<table>
<thead>
<tr>
<th>Mode №1</th>
<th>Mode №2</th>
<th>Comparison Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report Structure</td>
<td>Semantic Mode</td>
<td>There is <strong>no significant difference</strong> in performance of the recommendation component</td>
</tr>
<tr>
<td>Mode</td>
<td>User Activity Mode</td>
<td>The recommendation component in <strong>mode №1 outperforms</strong> that in <strong>mode №2</strong></td>
</tr>
<tr>
<td>Semantic Mode</td>
<td>User Activity Mode</td>
<td>The recommendation component in <strong>mode №1 outperforms</strong> that in <strong>mode №2</strong></td>
</tr>
</tbody>
</table>
How would you evaluate the clarity of the 1st/2nd/3rd task?
While completing which of the tasks have you...

…used the report recommendations most of all?

…received the most precise recommendations?