

## Lab-reports as a base for learning through writing in scientific genres – from an empirical perspective

Stein Dankert Kolstø  
University of Bergen  
[kolsto@ift.uib.no](mailto:kolsto@ift.uib.no)



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2

## Lab-reports and practical work in science Challenges

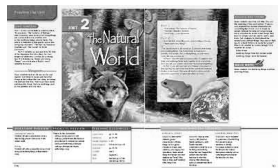
- Writing to learn + learn to write
- Learning
  - From observations to understanding
- Scientific literacy
  - Image of science (epistemology, argumentation, etc.)
  - Experimental report as a genre

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2

## Traditional scientific genres

- *Experiment* (experimental report, IMRAD)
- *Report* (textbooks)
- *Explanation*,
- *Exposition*
- *Bibliography* (Martin 1993)
- Defining genre
  - “staged, goal-oriented, purposeful” texts (Martin 1984).

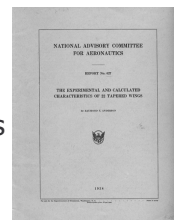


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3

## Experimental report

- **Main characteristic purpose**
  - Provides arguments for a hypothesis put forward
- **Arguments**
  - **Claim:** scientific hypothesis
  - **Justification:** Observations (and theory)



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4

## Inquiry learning

- Learning by doing
  - Reflection on observed changes
- What kind of reflections?
  - Scientific hypotheses
    - Constructivist view of the nature of science
    - Connecting observations and hypotheses
- Argumentation as evidence of learning



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5

## Research questions

- **How can we increase students' learning from writing lab-reports?**
  - To what extent do the students include argumentation in their lab-reports?
  - What characterises their use of arguments and genres in this context?
  - How can we understand these characteristics in light of the teacher's requirements for a good lab-report?

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6

## Method

- Data
  - 2 teachers and 2 classes
  - Interviews and documents with the teachers' requirements
  - 17 lab-reports
- Analysis
  - First: Constant comparative method
  - Final: Category based

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7

## Students arguments

■ *Results: [lists of measurements].  
Conclusion: It was the length of the pendulum that determined how many seconds it took.*

- Empirical hypothetical argument
  - Hypothesis as claim
  - Observations as justification

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8

## Students arguments

■ Result: The water is heated until it boils. There are a lot of movements in the water and it squirts out of the glass pipe going through the cork, because the particles need more space.

- Explanatory arguments
  - Observations as claim
  - Scientific theory as justification

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9

## Scientific argumentation

Claim → Data ↓	Observations	Hypothesis	Theory
Observations	X	Empirical hypothetical argument	Empirical theoretical argument
Theory	Explanatory argument	Theoretical argument	X

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10

## Identification of arguments

1. Identification of all sentences
  - preliminary qualitative analysis
2. Coding of each sentence
3. Inspecting possible argumentative relationships between sentences

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## Types of sentences

Types of single sentences	Frequency	On the average
Problem formulation	11	
Narrative	111	6,5
Factual methodological	1	
Factual scientific	39	2,3
Hypothetical	10	
Observational	88	5,2
Diverse	0	
In total	250	14,7

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## Arguments found (n=17)

Types of arguments	Frequency	On the average
Empirical hypothetical	12 (11)	0,7
Empirical theoretical	0	
Explanatory	15 (7)	0,9
Theoretical	0	
Methodological	2 (2)	
In total	29 (20)	1,7

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13

## Identification of genres

### ■ Section by section, then overall genre

- **Methodological narrative**
  - account of what was done, no methodological reflections
- **Scientific explanations**
  - Factual scientific statements and explanatory argument
- **Experimental report**
  - Hypothetical statement and empirical hypothetical argument

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14

## Genres found

Genres by sections	Frequency	On the average
Methodological narrative	19	1,1
Scientific explanations	12	0,7
Experimental report	22	1,3
<b>Overall genre</b>		
Mixture	9	
Experimental report	8	

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15

## Close to experimental report

- **Only one lab-report contained a methodological argument**
- 8 contained
  - methodological narrative,
  - section with observations
  - discussion of observations.
- **Implicit social goal**
  - Justify (tentative) conclusion using own observations as evidence

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16

## Mixed genre

- Did not contain arguments where the students used observations as evidence
- Mixture of methodological narratives and scientific explanations
- **Implicit social goal**
  - show the reader, the teacher, that one has understood the relevant theory

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17

## Teachers' requirements

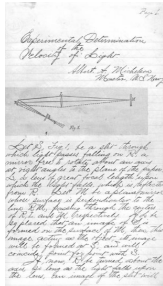
- **Teacher 1 required**
  - Uses right phrasings and concepts ...
  - Manage to show that the theory/purpose of the experiment is understood.
- **Teacher 2 required**
  - Hypothesis stated
  - Heading, Claim/hypothesis, Equipment, Drawing, Report, Results/explanations and Conclusion

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18

## Discussion

- Two types of reports
  - Both in line with requirements
  - Both have educational value
  - Both mediocre on NOS
- Close to two scientific genres
  - Experimental reports
  - Demonstration reports

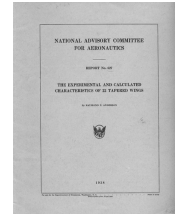


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19

## Experimental reports

- Suggest the following to be included in the requirements for lab-reports:
  - comments on the quality of methods and observations.
  - explicit empirical hypothetical arguments.
  - comments on the reliability of conclusions made.



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20

## Demonstration reports

- Suggest the following to be included in the requirements for lab-reports:
  - Explain the procedures you used to make possible the observations
  - Present the observations that are to be explained
  - Present the scientific explanations for the observations made



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21

## Conclusion

- Clarify purpose
- Include reflections on
  - Purpose of the genre in science
  - The nature of science
  - Presence of the genre in society, e.g. SSI
- Thank you for listening!



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22