Nationale Wiskunde Dagen

Chocolate Bar Machine Scheduling: Dunking into Inquiry-Based Learning and the World of Work

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University of Innsbruck

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mascil

The mascil Framework

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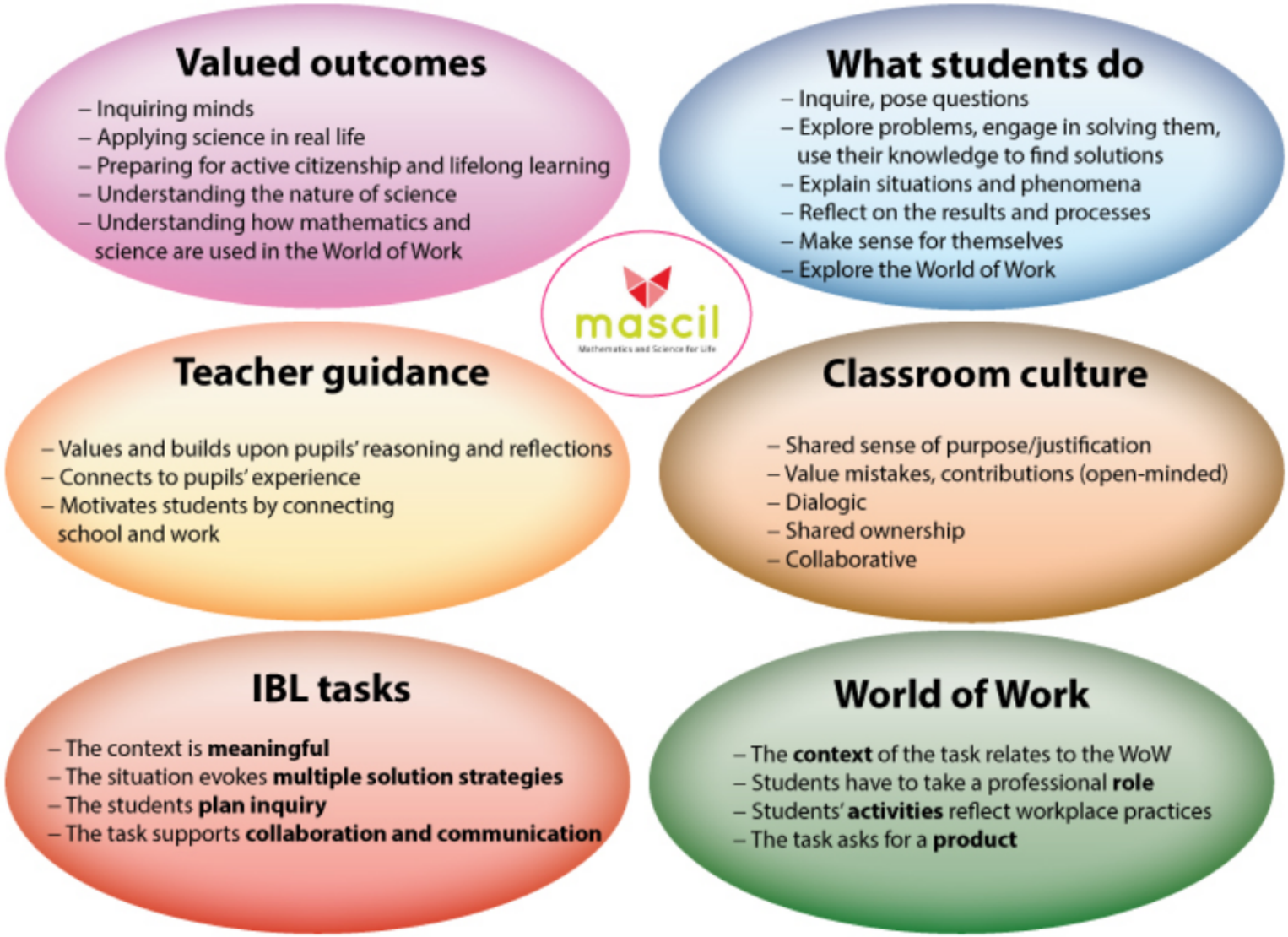

Dunking into IBT and WoW

Chocolate Bar Machine Scheduling

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- special task to provide a fast and effective tool involving pre-service and in-service mathematics teachers in a mascil learning environment

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Introduction

Chocolate Bar Machine Scheduling

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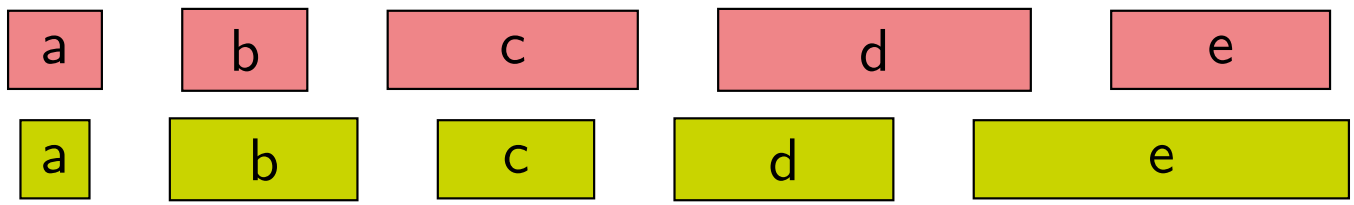
A chocolate factory produces different sorts of chocolate bars (hazelnuts, nougat, milk . . .). For each sort, the melted chocolate is deposited into bars on a machine M_1 and then the bars are packed on a machine M_2. The processing times of five sorts a, b, c, d, e on each machine are given.

	a	b	c	d	e
M_1	3	4	8	10	7
M_2	2	6	5	7	12

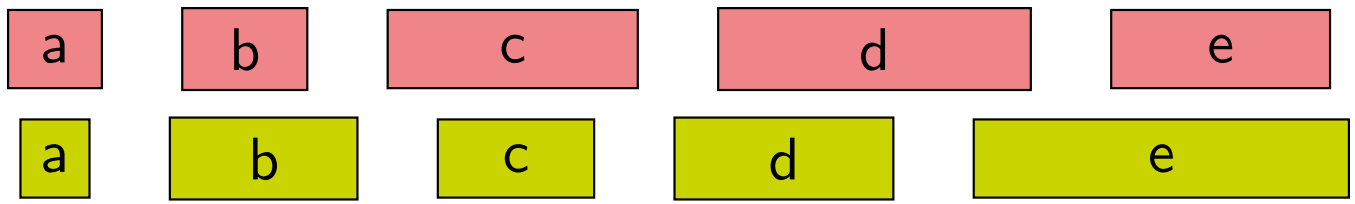


For which order of the sorts is the total processing time – the interval between the time the first sort starts on machine M_1 and the time the last sort leaves machine M_2 – the shortest? Describe your ideas and strategies!

Planning in een chocoladefabriek

Een chocoladefabriek produceert verschillende soorten chocoladerepen (melk, puur, hazelnoot, . . .). Van iedere soort wordt de gesmolten chocola met machine M_1 in reepvormen gegoten en daarna wordt met machine M_2 de reep ingepakt. De tijd die de machines nodig hebben voor vijf verschillende soorten chocola a, b, c, d, e en f zijn hieronder gegeven.

	a	b	c	d	e
M_1	3	4	8	10	7
M_2	2	6	5	7	12



Voor welke volgorde van de vijf soorten is de totale verwerkingstijd – de tijd tussen het moment waarop de eerste soort start op machine M_1 en het moment waarop de laatste soort ingepakt is in machine M_2 – het kortste? Beschrijf je ideeën en de manier waarop je het probleem hebt aangepakt.

Chocolate Bar Machine Scheduling

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Discussion

Intuitive Approach

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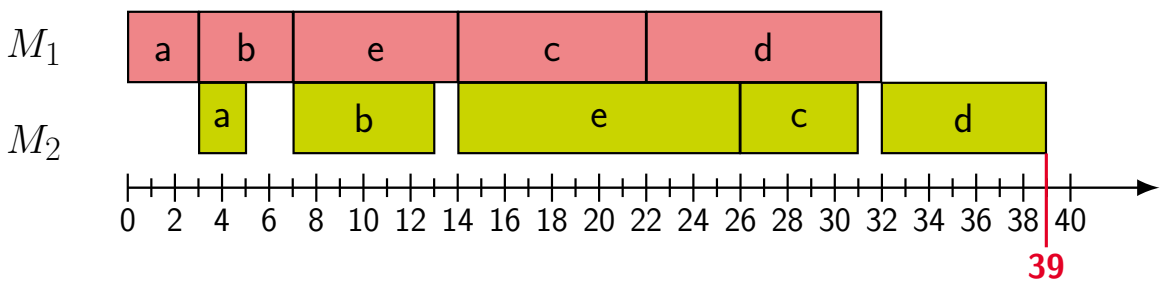
Hypothesis: "the shortest first"

1. Sort all jobs in ascending order with respect to their processing time at machine M_1.
2. Schedule the jobs in this order.

For our task:



Intuitive Approach

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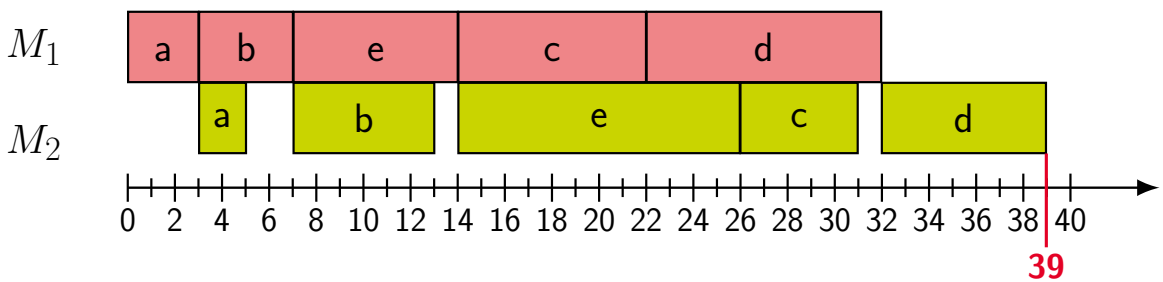
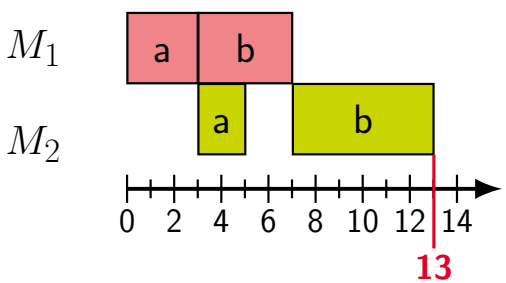
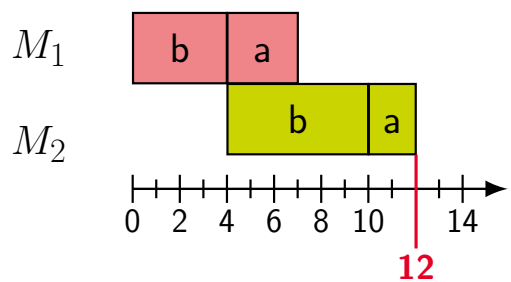


Counterexample to the hypothesis:





Inverse Intuitive Approach

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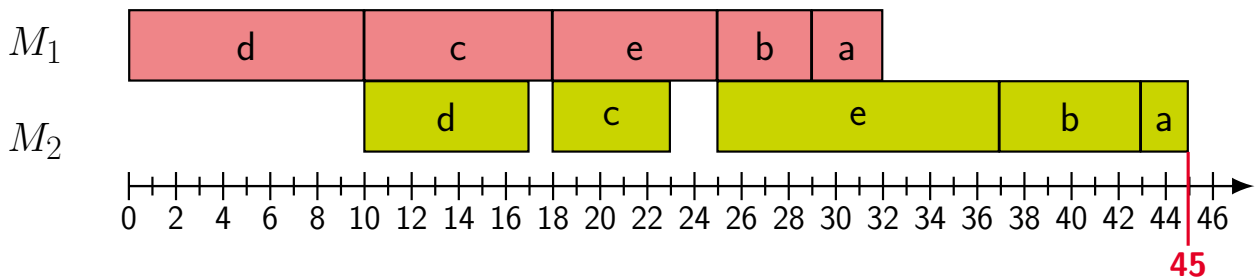
Hypothesis: "the longest first"

1. Sort all jobs in descending order with respect to their processing time at machine M_1.
2. Schedule the jobs in this order.

For our task:



Inverse Intuitive Approach

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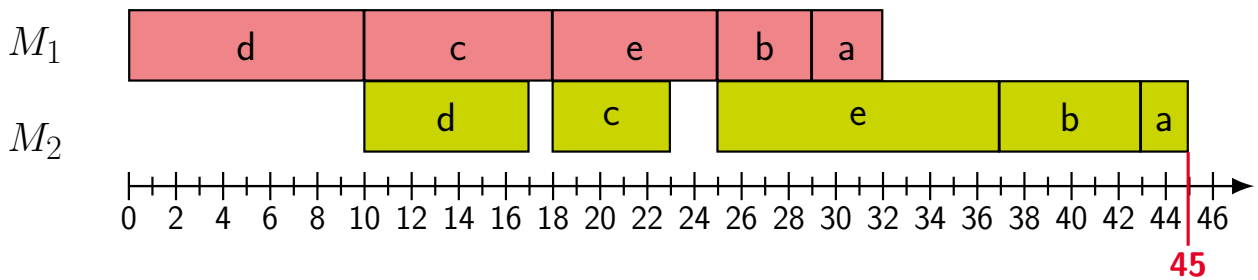

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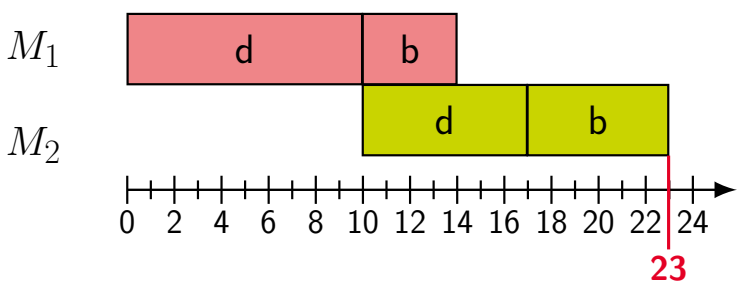

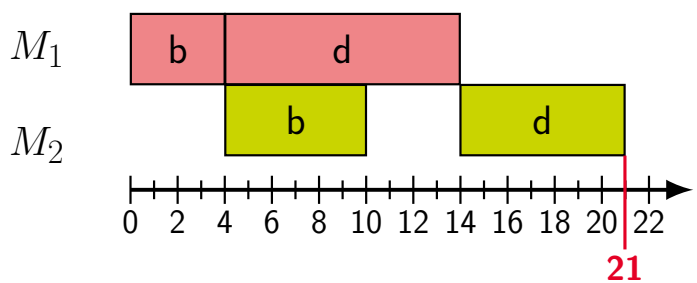

Johnson's rule

1. List the jobs and their processing times at each machine.
2. Select the job with the shortest processing time. If this processing time is at machine M_1, then schedule the job first. If this processing time is at machine M_2 then schedule the job last. In the case of ties, select the first listed job. In the case of ties between the processing time at machine M_1 and machine M_2 schedule the job first.
3. Eliminate the shortest job from further consideration.
4. Repeat steps 2 and 3, working towards the center of the job schedule until all jobs have been scheduled.

Johnson's rule

	a	b	c	d	e
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M_2	2	6	5	7	12

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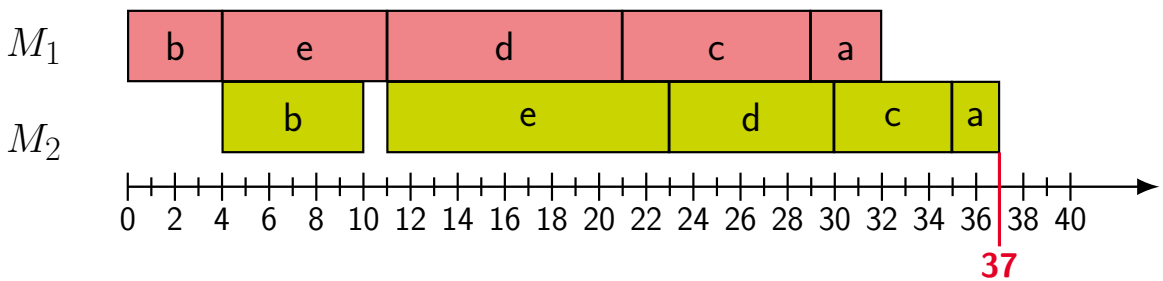
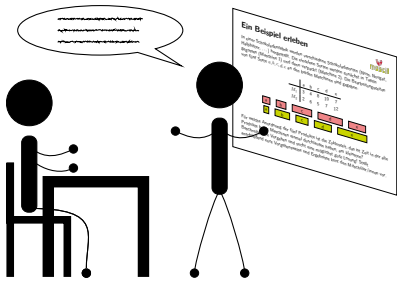


Implementation of the task



Introduction of the task

Implementation of the task

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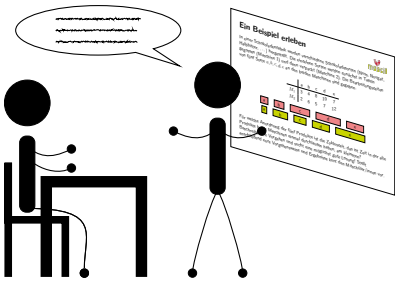

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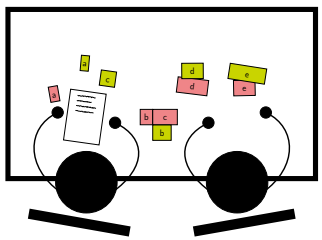

Development of the task

Implementation of the task

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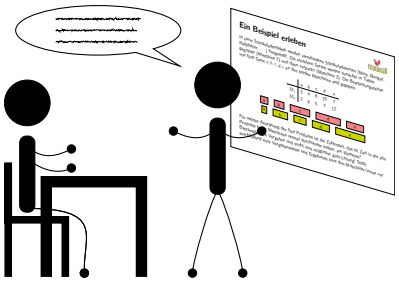

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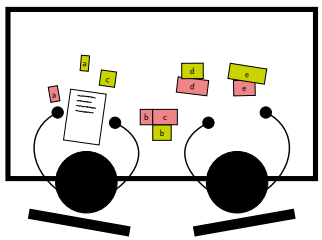

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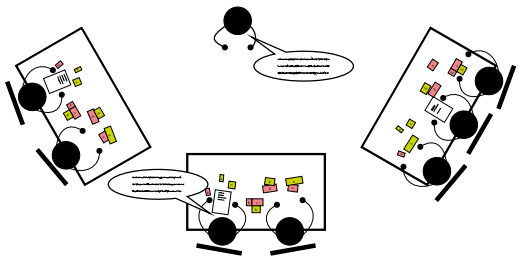

Discussion of the task

Implementation of the task

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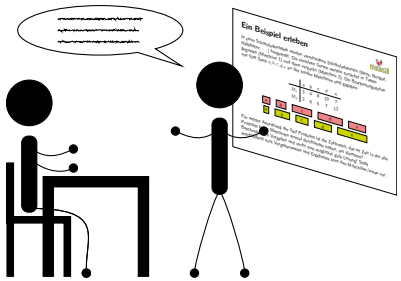

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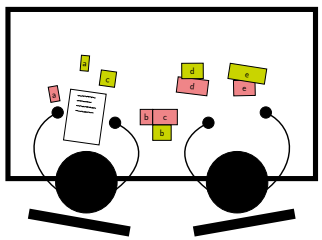

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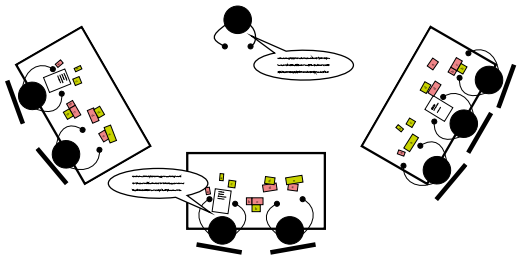

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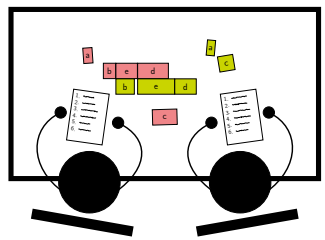

Systematization of the mathematical learning

Teacher's Questioning in IBMT

Menezes et al., 2013

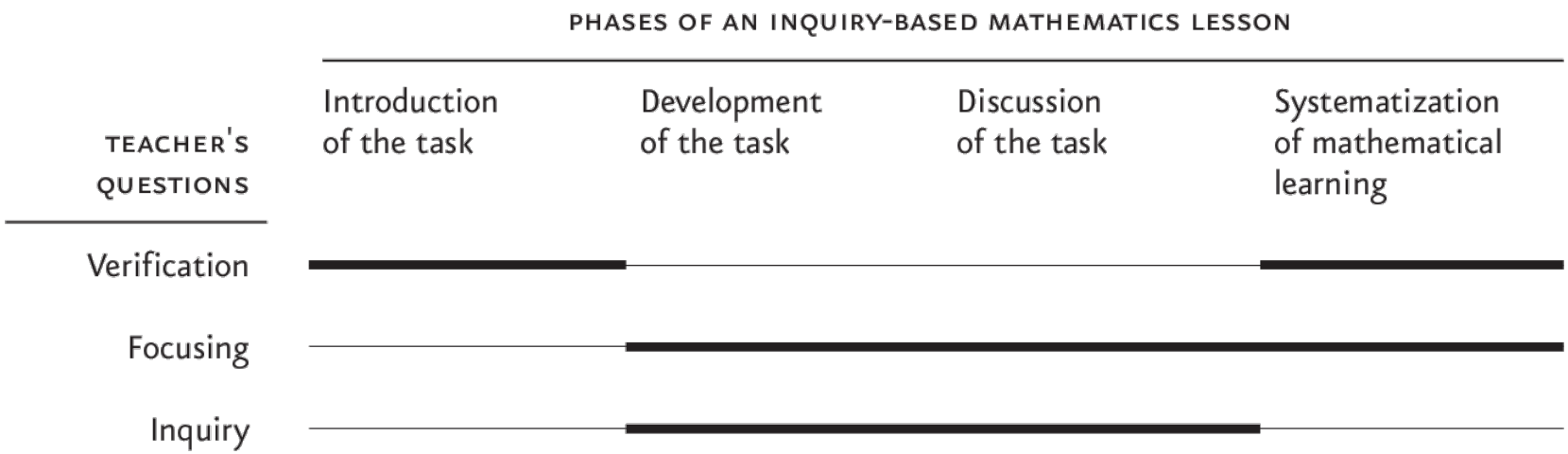

FIGURE I – THE TEACHER'S QUESTIONS IN AN INQUIRY-BASED MATHEMATICS LESSON

Quelle: Menezes et al., 2013: Essay on the role of teacher's questioning in inquiry-based mathematics teaching, p. 69

Teacher's Questioning in IBMT

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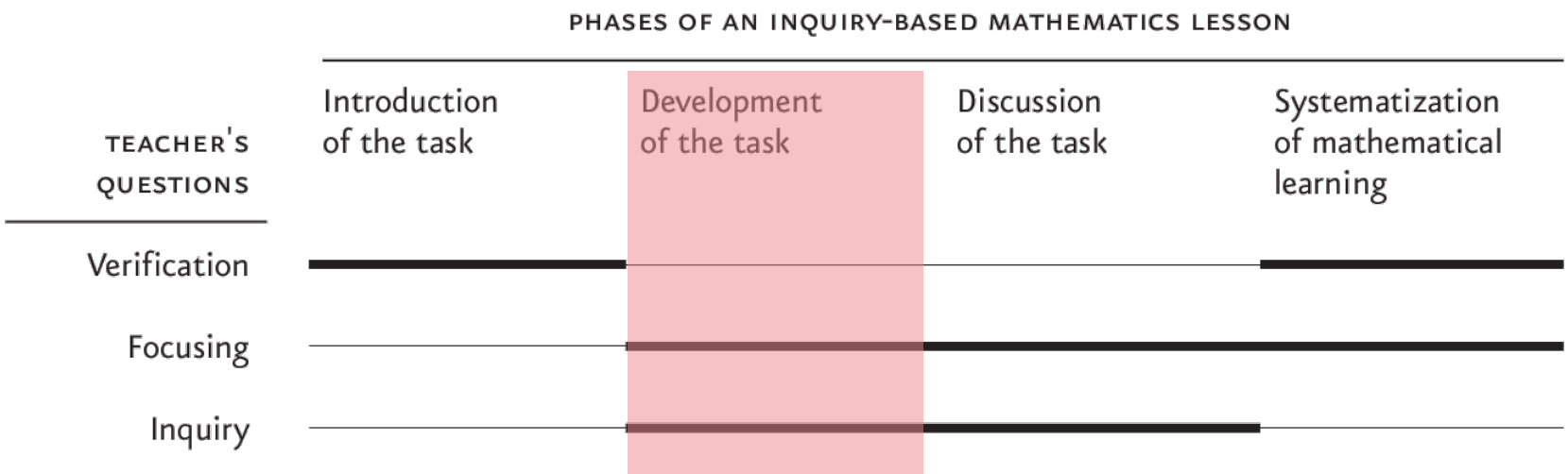

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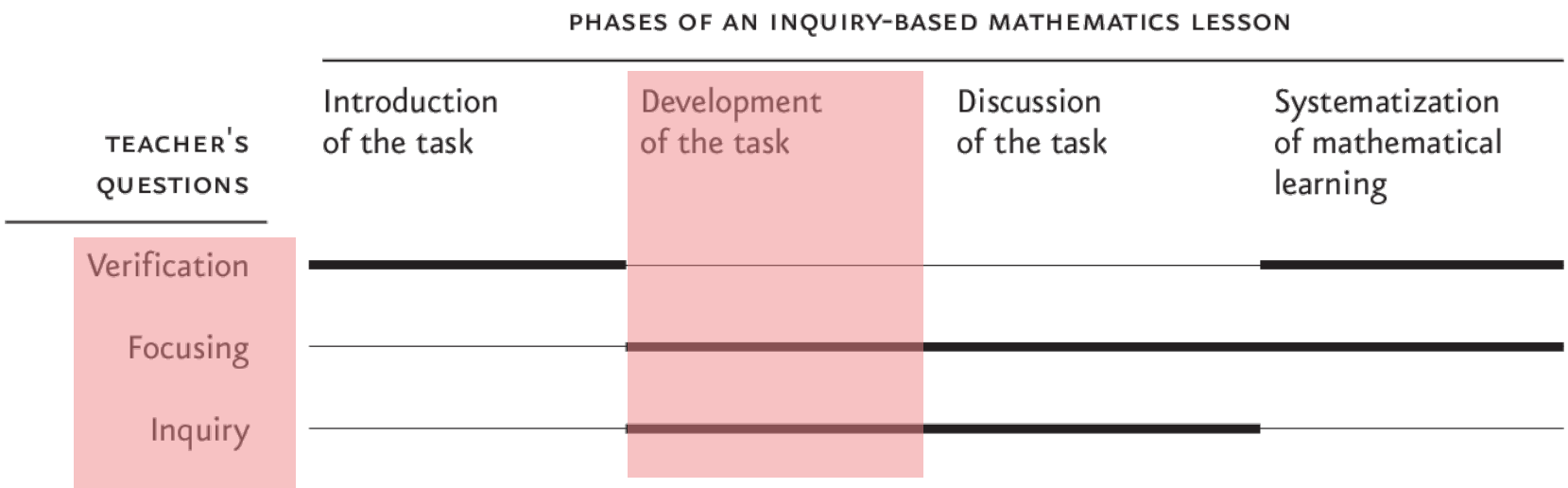

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Experiences in Austria

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Teacher's Questions

- Verification
- Focusing
- Inquiry

Experiences in Austria

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Teacher's Questions

- **Verification**
- Focusing
- Inquiry

"Do you always start with job A?"

Experiences in Austria

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Teacher's Questions

- Verification
- **Focusing**
- Inquiry

"Do you have an example in which it [the hypothesis that one should start with the shortest job] is wrong?"

Experiences in Austria

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Teacher's Questions

- Verification
- Focusing
- **Inquiry**

"It is difficult [to start] with [a job in] the middle if you have many [jobs]. But why do you believe that this [job] is in the front and that [job] at the end?"

Experiences in Austria

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Teacher's Questions

- Verification 14% (9)
- Focusing 32% (21)
- Inquiry 54% (35)

Summing Up

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- mascil framework

Summing Up

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- mascil framework
- worked on a mascil task

Summing Up

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- mascil framework
- worked on a mascil task
- different approaches

Summing Up

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- mascil framework
- worked on a mascil task
- different approaches
- implementation (different phases)

Summing Up

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Summing Up

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- mascil framework
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. . . comments?

Further Information

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Websites

- international: `http://www.mascil-project.eu/`
- subwebsite NL: `http://www.projects.science.uu.nl/Mascil/`

Contact

- E-Mail: `florian.stampfer@uibk.ac.at`

Thank you for your attention.