

Supplemental material

The supplemental material includes Teacher Survey 2015, Teacher Survey 2017, Teacher Survey 2018, and an overview of all identified codes regarding research question 2 (outcomes for students).

Teacher Survey 2015 (translated from Norwegian)

This survey collected data about teachers' experiences with Lektor2 *before* the implementation of the co-design tool. Responses from 205 unique curriculum units were collected, representing 130 teachers from 116 different schools.

* = mandatory question

Contact information

- County: *
- School name: *
- E-mail contact person: *

Practical information about the Lektor2 curriculum unit you have completed

- Title of the Lektor2 curriculum unit: *
- When was the unit carried out? *
- Has the unit been carried out in previous school years? *
Checkbox, alternatives: Yes, No
- Which STEM professional is involved in the curriculum unit?
- Have you signed a letter of intent with the STEM professional?
Checkbox, alternatives: Yes, No
- What year participated?* Multiple responses possible.
Checkbox, alternatives: 8, 9, 10, 11, 12, 13
- How many students participated? *
- In which subject(s) was the Lektor2 curriculum unit implemented? *
- To which main areas in the national curriculum is the unit connected?
- To what specific goals in the national curriculum is the unit connected?



- How much time did the students use to complete the entire Lektor2 curriculum unit, including students' preliminary- and follow-up work? *
- Have the students answered the student survey? *
Checkbox, alternatives: Yes, No

About the content of the Lektor2 curriculum unit

- Which teaching methods were mainly used in the Lektor2 curriculum unit? Multiple responses possible*.
Checkbox, alternatives:
 - Traditional teaching
 - Lecture by the STEM professional
 - Tour at the STEM professional's workplace
 - Student experiments
 - Demonstration experiments
 - Excursion in collaboration with the STEM professional
 - Retrieval and processing data from the STEM professional's workplace
 - Work with issues relevant to the STEM professional
- Where did the teaching take place? *
Checkbox, alternatives:
 - Only at the STEM professional's workplace
 - Only at school
 - As much at school as at the STEM professional's workplace
 - Mostly at the STEM professional's workplace, a bit at school
 - Mostly at school, a bit at the STEM professional's workplace
- Should the unit be adjusted before it can be used again? In what way? *

Student outcome

- Did the Lektor2 curriculum unit seem to inspire and motivate the students? *
Checkbox, alternatives: Yes, No
- Do you think that the unit has given the students increased learning outcomes? In what way do you experience this? *
- Any comments:

About collaboration with STEM professionals

- Was enough time set aside for the school to get acquainted with the STEM professional and his/her competence and field of work?
Checkbox, alternatives: Yes, No

- Was enough time set aside to give the STEM professional an introduction to the curriculum and the relevant learning goals for the collaboration?
Checkbox, alternatives: Yes, No
- Have the teacher and STEM professional discussed the unit in advance of the implementation? Checkbox, alternatives: Yes, No
- Has the teacher been present during teaching given by the STEM professional? *
Checkbox, alternatives: Yes, No
- Has the unit been discussed with the STEM professional after completion? *
Checkbox, alternatives: Yes, No
- Is there a need for educational guidance of the STEM professional? *
Checkbox, alternatives: Yes, No
- How is collaboration with STEM professionals from outside of school positive to you as a teacher?
- Has the school been in contact with the Lektor2 coordinator in your region?
Checkbox, alternatives: Yes, No
- If the school has had contact with the coordinator, what did the coordinator help with? Multiple responses possible.
Checkbox, alternatives:
 - Information about Lektor2
 - Establish contact with STEM professional
 - Establish arrangement with STEM professional
 - Arranged meeting with other schools in the region
 - Gave tips about suitable STEM professionals
 - Contribution to the curriculum unit
 - Other (please specify)
- Did you, or anyone working with Lektor2 at school, attend a regional meeting under the direction of the coordinator this school year?
Checkbox, alternatives:
 - Yes
 - There were no meetings in my region
 - No
- What will be useful content for future regional meetings for you as a teacher in Lektor2? Multiple responses possible.
Checkbox, alternatives:
 - Exchange of experience with other Lektor2 schools
 - Company presentations from relevant collaborators in the region
 - Instruction of suitable teaching methods

- Information about what Lektor2 entails
- Any comments on collaborating with a STEM professional or coordinator can be written here:

About the role of the school management

- Have you as a teacher got working hours set aside for planning and implementation of the Lektor2 curriculum unit? *
Checkbox, alternatives: Yes, No

Advice to other Lektor2 schools

- Based on your experience, is the benefit of Lektor2 worth the effort? *
Checkbox, alternatives: Yes, No

Teacher Survey 2017 (translated from Norwegian)

Teacher Survey 2017 collected data about teachers' experiences with Lektor2 *after* the implementation of the co-design tool. Responses from 202 unique curriculum units were collected, representing 177 teachers from 150 different schools.

* = mandatory question

Contact information

- County: *
- School name: *
- E-mail contact person: *
- How many different Lektor2 curriculum units have been implemented at the school in total? *

Practical information about the Lektor2 curriculum unit you have completed

- Title of the Lektor2 curriculum unit: *
- Which STEM professional(s) have you collaborated with in this curriculum unit? *
- Which year participated? Multiple responses possible: *
Checkbox alternatives: 8, 9, 10, 11, 12, 13
- How many students participated in this Lektor2 curriculum unit? *
- In which subject(s) was the Lektor2 curriculum unit implemented? *
- Which national curriculum area(s) were fully or partially covered by the Lektor2 curriculum unit? *
- How much time did the students use to complete the entire Lektor2 curriculum unit (including students' pre and post work)? Please provide the answer in hours: *

- Has the curriculum unit been carried out previous school years? *
Checkbox alternatives: Yes, No
- How many teachers at the school participated actively in planning and implementing the curriculum unit? *

About the content of the Lektor2 curriculum unit

- What was the topic of the Lektor2 curriculum unit? *
- What commission was given to the students? *
(If no commission was given to the students, what was the main goal for the students with the curriculum unit?)
- What kinds of activities did the students do to get the knowledge and skills needed to complete the commission? * Multiple responses possible.
(If the students were not given a commission, what activities were carried out to achieve the goals of the curriculum unit?)
Checkbox, alternatives:
 - The students visited the STEM professional's workplace
 - The students received guidance by the STEM professional
 - Guided tour in the workplace by the STEM professional
 - The STEM professional visited the school
 - Excursion in collaboration with the STEM professional
 - The students met with the STEM professional several times during the curriculum unit
 - Practical activities where the students had to use equipment
 - Tasks where the students had to justify their answers
 - Tasks that did not have a right or wrong answer
 - The students collected and processed data
 - The students worked with key concepts and background information
 - The students received training in how to present their solution
 - Reflection on differences and similarities between students' work and how the STEM professional work
- Other activities :
- How were the students assessed? Multiple responses possible. *
Checkbox, alternatives:
 - Oral feedback along the way
 - Oral feedback on end product (e.g. presentation, report, poster, debate)
 - Grade on end product (e.g. presentation, report, poster, debate)
 - Traditional test with grades
 - No assessment

- Other types of assessment:

Student outcome

1. How would you evaluate the student's outcomes from implementing the Lektor2 curriculum unit? * (Key words: learning outcomes, motivation, understanding of how STEM is used in working life, etc.)
2. What do you think of commission as a learning approach for the students? * (Key words: different student types, different academic level, work effort etc.)

About collaboration with STEM professionals

- How did you collaborate with the STEM professional ahead of the Lektor2 curriculum unit? * Multiple responses possible.

Checkbox, alternatives:

- Collaboration was not necessary because we reused a Lektor2 curriculum unit
- Practical clarifications, such as time and place
- Used a premade unit that the STEM professional offers schools
- Made the curriculum unit together
- Nothing – others at school put the curriculum unit and practical aspects in order

- Other:

- In what way did the STEM professional contribute to the curriculum unit? * Multiple responses possible.

Checkbox, alternatives:

- Design of commission to the students
- Presented the commission to the students
- Equipment
- Presented relevant academic information to the students
- Provide academic guidance to students along the way
- Gave the students access to data/information
- Told the students about the workplace - what they work with, who works there and their background
- Participated in the students presentation of the solution to the commission

- Other:

- How did you collaborate with the STEM professional after the students had completed the Lektor2 curriculum unit? * Multiple responses possible.

Checkbox, alternatives:

- Conversation/meeting about students' outcome from the unit
- Conversation/meeting about how the collaboration went
- Conversation/meeting on practical details

- No contact
- Other:
- What changes will you take to improve the Lektor2 curriculum unit in the forefront of the next implementation?
* Multiple responses possible.
Checkbox, alternatives:
 - Topic
 - Improve the quality of the commission the students receive
 - Improve the quality of the activities in the curriculum unit
 - Make sure the activities are more relevant to the commission
 - Spend more time with the STEM professional when planning the unit
 - Get the STEM professional more involved in the implementation of the teaching unit
 - Put more time aside for students' preparation
 - Put more time aside for students' follow-up work
 - Practical implementation
 - Do not want to carry out this Lektor2 curriculum unit next year
- Other:

About the role of the school management

- How was the management at your school involved in the Lektor2 curriculum unit? * Multiple responses possible.
Checkbox, alternatives:
 - Practical, such as adjusting schedules
 - Observed the Lektor2 curriculum unit
 - Participated in planning the content of the curriculum unit
 - Put aside part of my working hours for planning and implementing the Lektor2 curriculum unit
 - Paid extra for planning and implementation of the Lektor2 curriculum unit
 - Determined which teachers should implement the Lektor2 curriculum unit
 - Set time off for information about the Lektor2 curriculum unit to the teaching staff
 - Not involved at all
- Other:

Advice to other Lektor2 schools

- What is your most important piece of advice to other teachers who shall collaborate with STEM professionals from working life on STEM education? *

- Any other comments about Lektor2:

Teacher Survey 2018 (translated from Norwegian)

Contact information

- School name:

The co-design tool and collaboration with STEM professionals

1. How has the Lektor2 co-design tool and use of commission changed the way you work with professionals from working life?
2. Has the use of commissions changed what types of activities the students conduct in the Lektor2 curriculum unit? If yes, how?
3. In what ways do you collaborate with the STEM professional?
4. Has this approach (co-design tool and commission) changed your teaching more generally? If yes, how?

Overview of all identified codes regarding RQ2

CODE	DESCRIPTION	STUDENT		TEACHER	
		Total number	Percentage	Total number	Percentage
Collaboration	Descriptions of students working together or with help from STEM professionals. Sometimes highlights new ways of working together.	14	4 %	10	6 %
Connection to real world	Descriptions of connections/relationship between school work and work life, or seeing things "in practice", applicability of school STEM in the "real world".	76	24 %	96	55 %
Content knowledge	Specific content knowledge.	5	2 %	26	15 %
Creativity	Creative solutions were used or creativity was part of the process.	2	1 %	2	1 %
Different	Comparisons between Lektor2 and "normal" or usual classroom work/teaching.	52	16 %	6	3 %

Difficult	Challenges related to the curriculum unit.	30	9 %	5	3 %
Easier to learn	References to how the curriculum unit made it easier to learn or participate.	6	2 %	-	-
Enjoyable	Descriptions of the curriculum unit as enjoyable (fun, nice, liked it).	94	29 %	-	-
Exciting	Descriptions of this kind of teaching as exciting.	60	19 %	4	2 %
Increased understanding	Benefits in terms of greater outcomes or increased learning/understanding.	17	5 %	28	16 %
Interesting	Descriptions of the curriculum unit as interesting.	53	17 %	8	5 %
Meaningful	The relevance of the curriculum unit to everyday life, or as personally important/useful.	14	4 %	20	11 %
Motivating	Catchall code to note the curriculum unit was engaging or that the students were engaged - they worked well, etc. Often descriptions of engagement that is deeper/different than usual.	18	6 %	87	50 %
Negative	Catchall code for descriptions of logistical challenges – not that the work was "challenging", but that something went wrong or didn't go as planned. Most are descriptions of opportunities to improve.	37	12 %	8	5 %
Positioning	Specific descriptions of a student in relation to the work – often a new position/role.	8	3 %	4	2 %
Possibilities	New awareness of future possibilities, or realising that STEM is not for them.	44	14 %	14	8 %
Practices knowledge	Student engagement in practices (putting stuff together, calculations, lab work, writing surveys, etc.).	7	2 %	38	22 %

Understanding of work life	Understanding of how a business or the real world works, or an assessment of the job type (boring, interesting, etc.). Not just reference to the link between school and work, but to new understandings of what work life is like.	75	24 %	49	28 %
Transfer	References to students applying their knowledge in a new setting.	-	-	1	1 %
Number of coded responses (one response can have several codes)		319		174	