

Assessing Programming Tasks of Central Final Exams in Germany

Domain

Objective:

Competencies required to pass the programming tasks of final computer science exams at German high school.

Competencies required to pass the final computer science exams at German high school.

Competencies required to pass any final computer science exam at school.

Competencies required to pass any computer science exam at school.

Motivation

Motive I

Findings may be relevant for practicing computer science teachers.

Teachers could introduce a pre-test right before the final exams that diagnoses a student's weaknesses regarding the most common competencies. Those could be trained short-term to accomplish better results.

Motive II

Findings may be relevant for computer science expert conferences at school.

The school's computer science expert conference could benchmark the current curriculum for the most common competencies to check if the curriculum aligns with the central final exams.

Motive III

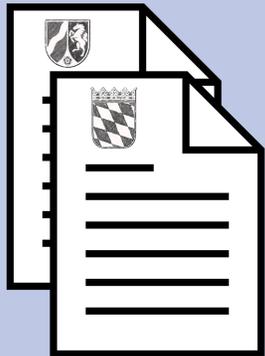
Findings may be relevant for the scientific community.

- The findings could reveal considerable under- or overrepresentations of single competencies or categories of those.
- The findings may hint at a competency profile specific to single a federal state or country.
- The domain hasn't been investigated sufficiently yet.
- The findings could reveal competencies specific to the programming used for the computer science courses. (e.g. JAVA)

"Which Competencies are Required to Pass the Programming Tasks of the Central Final Computer Science Exams at German High School?"

Methodology

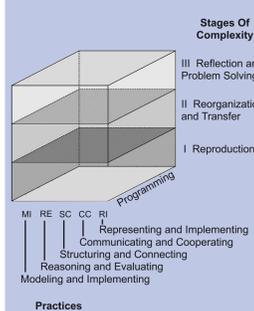
Acquiring central final examination tasks from 2016 to 2019 from North-Rhine Westphalia and Bavaria.



Identifying eligible tasks dealing with programming. Arranging content sections in a way suitable for content analysis.



Coding the identified content sections with a category system (manual) based on competencies for Higher Secondary Education for Computer Science by the German Informatics Society.



Quantitative evaluation of the occurrences of individual competencies. In addition each worded competency can be traced down to and evaluated as a distinct Practice and Stage Of Complexity.

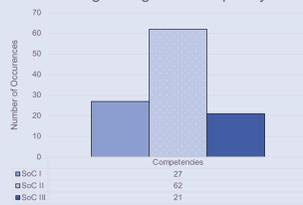
RI-1	CC-1	SC-1	RE-1	MI-1
RI-2	CC-2	SC-2	RE-2	MI-2
RI-3	CC-3	SC-3	RE-3	MI-3
RI-4	CC-4	SC-4	RE-4	MI-4
RI-5	CC-5	SC-5	RE-5	MI-5
RI-6	CC-6	SC-6	RE-6	MI-6
RI-7	CC-7	SC-7	RE-7	MI-7
RI-8	CC-8	SC-8	RE-8	MI-8
RI-9	CC-9	SC-9	RE-9	MI-9
RI-10	CC-10	SC-10	RE-10	MI-10
RI-11	CC-11	SC-11	RE-11	MI-11
RI-12	CC-12	SC-12	RE-12	MI-12
RI-13	CC-13	SC-13	RE-13	MI-13
RI-14	CC-14	SC-14	RE-14	MI-14
RI-15	CC-15	SC-15	RE-15	MI-15
RI-16	CC-16	SC-16	RE-16	MI-16
RI-17	CC-17	SC-17	RE-17	MI-17
RI-18	CC-18	SC-18	RE-18	MI-18
RI-19	CC-19	SC-19	RE-19	MI-19
RI-20	CC-20	SC-20	RE-20	MI-20
RI-21	CC-21	SC-21	RE-21	MI-21
RI-22	CC-22	SC-22	RE-22	MI-22
RI-23	CC-23	SC-23	RE-23	MI-23
RI-24	CC-24	SC-24	RE-24	MI-24
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RI-30	CC-30	SC-30	RE-30	MI-30
RI-31	CC-31	SC-31	RE-31	MI-31
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RI-41	CC-41	SC-41	RE-41	MI-41
RI-42	CC-42	SC-42	RE-42	MI-42
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RI-45	CC-45	SC-45	RE-45	MI-45
RI-46	CC-46	SC-46	RE-46	MI-46
RI-47	CC-47	SC-47	RE-47	MI-47
RI-48	CC-48	SC-48	RE-48	MI-48
RI-49	CC-49	SC-49	RE-49	MI-49
RI-50	CC-50	SC-50	RE-50	MI-50

"We Identified a Total of 271 Sub-Tasks in the Given Data Set. 70 of Which were Programming Tasks. We Assigned 214 Competencies to Those Tasks."

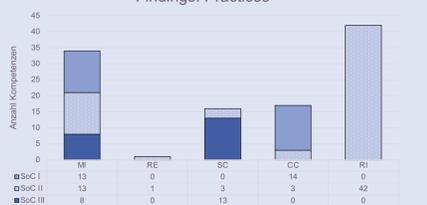
Findings

31 Programming Tasks (40%)
-
360 Scoring Points Allocated (45%)
-
110 Competencies Identified

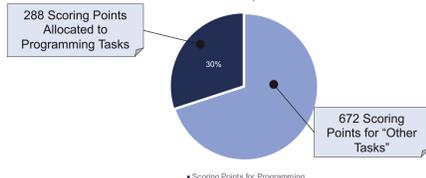
Findings: Stages of Complexity



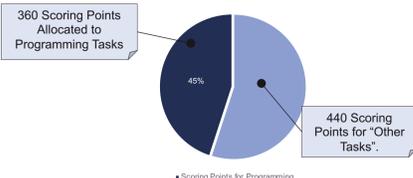
Findings: Practices



Ratio of Programming Tasks in North Rhine-Westphalian Exams



Ratio of Programming Tasks in Bavarian Exams



Conclusion

MI-1	MI-2	MI-3	MI-4	MI-5	MI-6	MI-7	MI-8	MI-9	MI-10	MI-11	MI-12	MI-13	MI-14	MI-15	MI-16	MI-17	MI-18	MI-19	MI-20
RE-1	RE-2	RE-3	RE-4	RE-5	RE-6	RE-7	RE-8	RE-9	RE-10	RE-11	RE-12	RE-13	RE-14	RE-15	RE-16	RE-17	RE-18	RE-19	RE-20
SC-1	SC-2	SC-3	SC-4	SC-5	SC-6	SC-7	SC-8	SC-9	SC-10	SC-11	SC-12	SC-13	SC-14	SC-15	SC-16	SC-17	SC-18	SC-19	SC-20
CC-1	CC-2	CC-3	CC-4	CC-5	CC-6	CC-7	CC-8	CC-9	CC-10	CC-11	CC-12	CC-13	CC-14	CC-15	CC-16	CC-17	CC-18	CC-19	CC-20
RI-1	RI-2	RI-3	RI-4	RI-5	RI-6	RI-7	RI-8	RI-9	RI-10	RI-11	RI-12	RI-13	RI-14	RI-15	RI-16	RI-17	RI-18	RI-19	RI-20

Stages of Complexity: Our findings match the advices by the *Unified Requirements for Examinations in Higher Secondary Education*.

Practices: Reasoning and Evaluating (RE) is heavily underrepresented among both federal states. Structuring and Connecting is less common in the Bavarian tasks.

Competencies: We found that most competencies from the manual did not occur in the set of programming tasks. Only 16 out of 52 occurred at least once.

Time and Score: We found that the relation of total scoring points to the time period assigned to the full exam differs about 10% from NRW to Bavaria.

Outlook (1*): Analyzing additional federal states would allow us to locate our findings in the bigger picture of the German educational system.

Outlook (2):** Assessing the remaining non-programming tasks ("other tasks") would allow us to determine the overall requirements and evaluate our category system.

References

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