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Regular expressions in programming. Identifying typical applications of simple regular expressions through interactive, discovery-based learning (2nd year HTL, 10th grade)

## Introduction

This Lesson Study deals with one of the central, yet highly challenging topics in programming. The students of the 2nd year come into contact with this complex of topics for the first time. The LS-research lesson (LS-RL) prepared within the framework of the Lesson Study (LS) is, so to speak, the prelude to a constitutive part of computer science education.

Main objectives and key topics of the LS-RL:

Learners will be able to

- (1) identify typical uses of simple regular expressions through interactive discovery learning.
- (2) Build sets of words from regular expressions.
- (3) form regular expressions independently.

This LS-RL is designed to familiarise students with the mechanics of descriptive languages for pattern recognition. This is particularly important as the same concept is central to databases (Year 3), operating system administration (Year 3 and 4) and web development (Year 3 and 4).

The LS-RL should be designed to create a sustainable learning experience. This seemed to be ensured with the methods of inquiry-based learning.

Although it is a very complex theoretical topic, an immediate, well-supported learning path should be designed. This was to be done by deriving concrete applications and scaffolding through a cheat sheet.

## Context and process

The LS took place at the end of the school year, i.e., the class was already familiar with the teacher's methods. As there were only a few topics left, this one was chosen for the LS because of its long-term significance.

The competences acquired from the LS in theory lessons could then be implemented, consolidated, and deepened in the subject-specific practical lessons. Although the contents did not play a role in the assessment at the respective school level, the pupils were aware of the relevance for their further educational career and actively participated in the lessons.

The LS-team consisted of three teachers of subject theory lessons (Harald Haberstroh, Wolfgang Schermann, Alexander Wöhrer), as well as the HS Professor and LS-expert Claudia Mewald as knowledgeable other, observer and interviewer, and the language teacher and didactician Michael Krebs as knowledgeable other and observer.

The students of year 2AHIF of the HTL Wiener Neustadt, Höhere Abteilung Informatik, were involved in the selection of the LS-topic by voting and were available as interview partners for the follow-up.

The topic proposal "Regular Expressions" seemed particularly suitable to all team members, as it offers rich visualisation possibilities and application examples. Nevertheless, an equivalent alternative was found with the topic "Group Change". The decision on the thematic focus was left to the students.

In a vote on which topic should be taught in the LS, 75% of the students clearly decided in favour of the topic "Regular Expressions".

The LS-RL was prepared by the subject teachers in team meetings together with both knowledgeable others. In these meetings it became apparent that all teachers involved relied mainly on teacher-centred methods. The knowledgeable other Claudia Mewald was therefore consulted with the wish for more interactivity and recommended trying out inquiry-based and scaffolding methods. Now the existing teaching materials were adapted in teamwork, or new working materials were created.

Claudia Mewald and Michael Krebs, as well as the non-lecturing subject teachers, were invited to observe the two lessons.

The two LS-RL (taught by Wöhrer and Schermann) were held as double lessons within one week on different days and discussed and adapted in subsequent feedback rounds. Thus, the second LS-RL by Wolfgang Schermann was already a revised version of the original planning.

The reports were drafted and submitted within the following days using the LS4VET e-learning course materials from Module 2.

#### Focus

In the team meeting, there was a unanimous wish for increased interactivity and individualisation, which could be implemented in the method of discovery learning.

The observers followed the lessons with the help of prepared observation sheets from the LS4VET e-learning course Module 2 and reported on them in the subsequent discussion. In addition, students from groups predefined according to expected performance levels were interviewed. The results of these interviews were also included in the follow-up.

#### Results

The fact that a change in teacher behaviour is immediately noticed by the class was one of the strongest impressions of this LS. The students clearly reacted positively and also expressed their satisfaction with the methods used in the feedback interviews. In general, they were very reflective about their own learning experience. They were able to give precise information about what facilitated their learning success and where they still needed additional support.

The very fact that a lesson is defined as a LS research lesson ensures a noticeably increased attention and willingness to make an effort on the part of all participants. The significantly increased time spent on preparing the LS research lesson was also reflected in a measurably better lesson outcome. After this double lesson, almost all pupils in the class achieved the basic competences in the subject area presented. It is therefore to be expected that the teaching model developed will also be more successful than average in future use.

Both teaching staff and observing teachers benefited from the in-depth reflection phase. Both general and methodological-didactic questions as well as subject-didactic approaches could be discussed and reflected upon.

In any case, the support of a proven expert in the field of LS contributed significantly to the success of the project. For further LS projects, it is highly recommended to bring a competent person into the team who is familiar with the processes, requirements, and potential of a LS.

#### Outlook

The LS at our school, as a departmental initiative limited to one subject area, is quite suitable for bringing the culture of lesson observation within the school or within the subject area to a higher level. Instead of mere, rather passive observation programmes, LS offers an active, reflected form of lesson development. It not only serves as a concrete source for suitable lesson models, but also for the professional development of the teaching staff.

We will not only recommend LS, but definitely establish it as a measure for professional development through the department at the school, or school-wide continuous professional development.