**Systems for automatic assessment of programming tasks**

**in improving teaching and learning programming languages in Slovenian schools**

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Despite different studies and research trying to develop models that can predict student success in programming courses, the main success factor is still the number of programs written by the students. It is often said that learning to program can only be learnt by doing it; by sitting at the computer and writing programs. Teachers are required to both encourage students by exposing them to numerous problems and supervise the students' attempts to solve them.

Teaching programming is thus most efficient when the students perform the assigned tasks while the teacher points out the shortcomings and offers assistance with correcting the mistakes. Since good and swift feedback is vital for quick progress, manual assessment of the large volumes of students' code is out of the question. Therefore, systems for automatic assessment of programming tasks have become a popular choice in programming courses. The obvious benefits of automatic assessment are objectivity, consistency and speed of assessment, as well as constant availability. One of the most important advantages is the immediate feedback students get.

At the Faculty of Mathematics and Physics we developed a system called Project Tomo (<https://www.projekt-tomo.si/>). The service is designed in such a way that it requires little or no additional work from students and teachers, enabling them to focus on the content. Furthermore, the service can be used in almost all teaching environments, as it can be adapted to most programming languages and has minor technical requirements. Currently the service supports Python, Octave and R programming languages. However, the development towards inclusion of C#, Java and other languages is already on the way. All that needs to be done is to provide a program for the communication with the server. The "only" problem is the lack of resources.

Though the service was primarily meant to be used internally, we imagined that it should prove useful in other teaching environments. The system is completely open and available to all. Thus currently over 25 schools are already using it. We got some quite positive responses from teachers. If we cite Klemen Bajec, computer science teacher at the Grammar School Vič, Ljubljana: "TOMO allows me to differentiate in teaching. Students can progress at different speeds. In this way, some students can learn a lot more as if everyone solves the same tasks."

We have already accumulated more than 110.000 students' attempts along with their history. One of our goals is to analyze those attempts to improve the feedback for the most problematic tasks. We hope this will help overcoming the most common mistake patterns done by the students. Several other improvements are also planned. However, as mentioned before – resources available are far behind the ideas.