BACK

WAYS OF ASSESSMENT IN CAS-ORIENTED MATHEMATICAL EDUCATION - NEW EXPERIENCES, FIRST RESULTS

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Abstract
In Austria, teachers of Mathematics at schools which are preparing students for university can choose and formulate their own test problems. Since 1985 they have been in a position to allow students to use electronic calculators in tests, if they had enough practice in class with it. From 1991 onward computer algebra systems like DERIVE or MATHEMATICA have been used. In doing that three models of assessment for tests have developed which will be described in part 1. In the Austrian CAS II Project (1997/98) the students used TI-92 in Mathematics in their lessons and in their tests. The experiences made by the research teachers have been collected (part 2) and new models of assessment have been worked out. They were tried in 1999/2000. My experiences with such a model in form 11 are described in part 3.

The use of computers in mathematical education in schools depends on some very important conditions. The use of the computer has to be required in the **curriculum**, sufficient **hardware** and good **software** has to be bought and the computer is to be admitted in **oral and written exams**, inclusive the final examinations. All these conditions have been fulfilled to a great extent for grammar schools, business academies, secondary technical and trade schools in Austria in the last ten years.

Two organisations for mathematics teachers, the **AMMU** (Arbeitsgruppe für Modernen Mathematik-Unterricht, ***http://www.ccc.at/ammu***) and the **ACDCA** (Austrian Centre for Didactics of Computer Algebra, ***http://www.acdca.ac.at***) began to exist. The activities of these two organisations are the reason, why more & more teachers in Austria allow students to use personal and pocket computers in mathematics when writing tests.

But it is not easy for the teachers, because in big classes there are *often more students than computers available, not every student has a computer at home and not all lessons can be held in a computer lab.* Therefore three practicable models for tests with the help of computers have developed.

Model 1 with ***different examples for students with/without CAS*** *is a favourable interim model for classes, where a strong minority is against using CAS in mathematics tests.* It is a fact that the handling of the computer and the finding of appropriate DERIVE-commands leads to a remarkable difference after some weeks between those students who have the chance to practise at home and those who do not have this opportunity. (WURNIG, 1996)

Model 2 with ***time-sharing on the same computer*** *between two students is only sensible if 50% of the test and time can be worked on without a PC and 50% with a PC.* This model was partly used in the Austrian CAS-I-Project (DERIVE). The two students sharing the time of working on the computer, got different examples. Changing turned out to be no problem.

Model 3 with ***50% team work alternating with 50% single work on the same computer,*** *is part of the concept MATHS & FUN with MATHEMATICA.* The concept can be studied under the homepage http://www.mathsnfun.ac.at/mf/EnglischeVersion/index1.htm. It is an educational experiment at the Business Academy I in Graz.

But the real goal is one student per computer. In the German report of the Austrian CAS-I-Project (DERIVE-Project) H. HEUGL writes: „It would be *ideal if every student had a portable CAS-calculator, which could be linked up with the CAS in a computer lab, in his school bag.*"

In the **Austrian CAS II Project (TI92-Project) 1997/98** the students of 70 research teachers wrote their tests in mathematics with the TI-92. At their final meeting in 1998 the teachers collected their most important results: (LECHNER/WURNIG, 1998)

- the problems in tests have to be **more goal oriented** → **text longer** instead of shorter.
- for solving problems it is very important **not always to insist on the use of the TI-92**.
- students find **new ways with the TI-92** → more work for the teacher.
- TI-92 has no floppy → **much documentation** in test book, therefore **fewer examples**.
- **difficult decision**: What is to be the **minimum knowledge** in mathematics **without** the TI-92?
- **difficult decision**: What **minimum knowledge of TI92**-commands is an absolute must?
- **modules** and **programmes** are a good chance **for good students** → **a new problem for bad students**.

In spring **1999** a team of teachers under the leadership of H. Heugl developed **some variants of a new model of assessment**. In accordance with the Ministry of Education experimental studies to test the new model were carried out in 1999/2000. I chose to use the following **variant in form 11**: The fundamental idea of this variant is to use the pre-set time for written tests in a school year - 350 minutes in form 11 - in different ways:

- For short tests - up to a maximum of 25 minutes - to check reproductive skills or reproductive knowledge with or without CAS.

- For one longer test per half-term, e. g. 100 minutes, to check problem solving skills. There should be sufficient time to experiment, and to use materials which have been worked out at school or at home.
- For working out a short chapter of mathematics, which has not been dealt with at school. Each student should prepare his short chapter in written form at home and present it to his classmates at school.

The shorter tests and longer problem-oriented tests had a very different impact on my students of the 11th form. Many students did not work hard enough for the short test in which the basic skills were examined by means of easy short problems and so the test results were bad. The problem-oriented tests, which were written later on, were taken more seriously, because they wanted to get good marks in their reports and consequently the achievements were much better.

The preparation of a short chapter of mathematics at home and the ensuing presentation at school proved to be the most difficult part on behalf of the students. Most of the students had never before prepared a disposition for a theme at school. It took me two lessons and many discussions to make even good mathematicians understand how to prepare an acceptable written and oral presentation.

References

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