

## NEW THREE-TIER MODEL OF ASSESSMENT IN CAS CLASSES

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### ***Abstract***

*In the project that was part of Project CAS III of ACDCA (group 4: New Methods of Assessment), I changed the traditional exams used in Austrian schools following a three-tier model of assessment. The model expands the idea of the two-tier assessment including a third strand of cross-curricular work to be done by the students. Consequently, learners have to show their proficiency not only in calculation and problem solving, but also in so-called "focus papers". For these focus papers, students have to choose a topic that connects mathematics to either economics, finance or physics, do individual research, write up a paper, and present their findings to their colleagues in class. The third exam of each semester is made up of questions concerning these presentations. This summary includes examples and reflections.*

The presentation introduced a project currently in use in its trial phase at my high school in Berndorf, Austria. The project is geared towards 9<sup>th</sup> graders who are using the TI92 for the first time. I am convinced that the teaching with the support of a computer algebra system as used by the TI92 has to lead to new methods of assessment as well.

In my talk I focused on the way traditional exams were enriched or replaced by different, new exam formats. In essence, I propose a three-tier model of assessment: The 6 usual tests of 50 minutes each are replaced by 3 written tests per semester that vary in both allotted time and aims of assessment. At the onset of each semester students are to take a 30-minute exam geared towards testing their ability to perform calculations by hand and handling the TI92, respectively. The second, 100-minute exam is open-book and aims at assessing students' problem solving skills. It is followed by a 20-minute quiz that covers the material presented in students' oral talks or in "focus papers" throughout the semester. In addition to these

written forms of assessment I introduced the idea of these yearly "focus papers" and oral presentations thereof done by each student each year. The independent research, experiments and reading for the focus papers help students integrate math skills and the use of English across the curriculum as they rely on material from the areas of physics, finance and economics written in English.

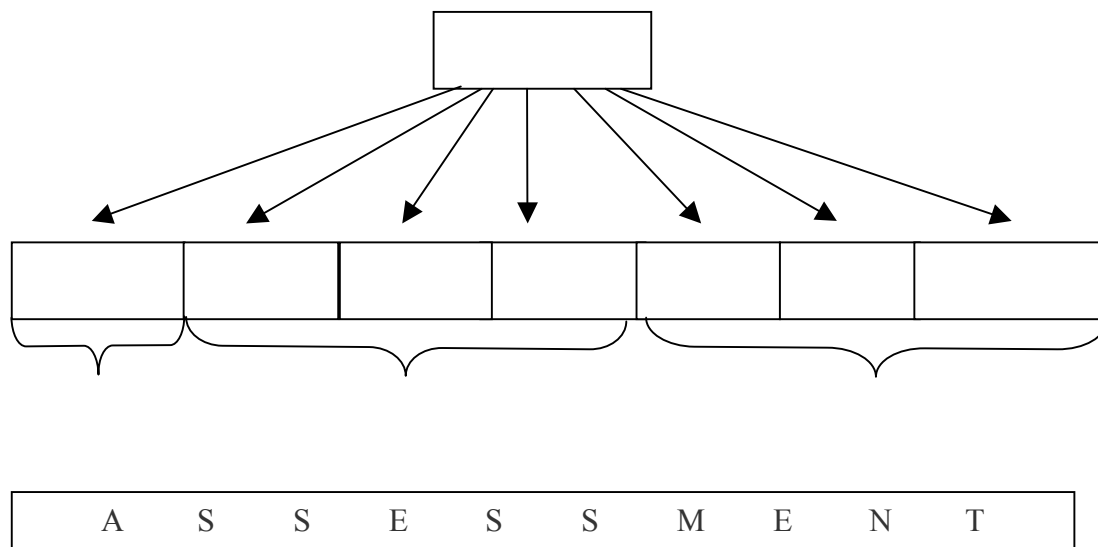


Figure 1

In short, the assessment has been remodeled to fit the new teaching situation and I hope for positive backwash to the learning with the TI92 in class. It was logical to look for test formats that would further motivate the kind of teaching done in the project, and the ones used at our school seem to have worked for both teachers and students over the course of the past semesters.

Dr. Heugl has introduced the short handling tests in his presentation and I, therefore, did not touch upon them in my talk. The reader is welcome, of course, to discuss them with me via email.

In the limited space here I would like to present the problem solving tests in some greater detail by showing the text of some problems. In doing so I want to exemplify the kinds of skills needed on the part of the students,

especially those skills that go beyond the scope of traditional testing. Let me also mention that these tests constitute a good preparation for Matura. Last but not least, I provided a list of focus topics as given to the classes. Unfortunately it would exceed the given space limitations to include it here. At the conference I was able to share some examples of handouts and additional material provided by the students for their colleagues when they presented their focus papers as well as a short video extract so that participants could get an idea of the student presentations. (Please visit the [ACDCA homepage](#) if you are interested in greater detail!)

1.) max.mobil (see adjunct 1)

When you compare the monthly basic rate of the various tariff models to the price of 1-minute units for calls to the Austrian phone net in the time of MO – FR; 7am – 8pm you will see that the unit price for calls is reduced as the basic rate increases.

- a) Produce a table and introduce / describe a linear function that approximates this relationship. Mention explicitly all parameters used on the TI 92 leading to the window in which you graph the regression and the 3 ordered pairs. Draw the graphics window into your exercise book.
- b) If this function represented a meaningful business-like relationship, what amount per minute would max.mobil have to charge its clients in case there were a tariff model without a basic rate?
- c) Interpret  $m$  and  $b$ !

2.) In the adjunct (2) you will find real estate offers from the advertisement section of a magazine. Choose at least 8 offers (with a rather small area) and put the data (flat size in  $m^2$  and price of flat) into your data-matrix editor.

- a) Sort the table according to increasing size. Which linear function approximates this relationship? Also describe how you represent ordered pairs and functions in the graphics window! (Don't forget to mention the window parameters you used.)
- b) What is the mean price per  $\text{m}^2$  when you buy a house? Which offer do you find appealing? Why? In how far does the regression line fall short of representing the true relationship or price and size? What would a more realistic function look like?
- c) Predict what size of flat (from – to) you would be able to get at the real estate market if you had about 2 million Austrian shillings at your disposal (capital and loans)? At least how much money do you need if you want to buy a house with  $180\text{m}^2$ ? Explain your answer!

Figure 2

In conclusion it can be said that the main difficulties of such tests lie in the focused search for relevant data (e.g. in problem 1 tariffs have to be extracted from a downloaded internet page) as well as in the choice according to personal interest (e.g. in problem 2 students could choose from 60 offers in a real estate magazine). In addition, the learners have to show their understanding and verbalize their interpretations. The new model of assessment was introduced successfully and appreciated by students, parents and teachers alike.