

CAS AT VOCATIONAL SCHOOLS IN BADEN-WUERTTEMBERG

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Abstract

CAS-systems are going to enter the curricula of different kinds of vocational schools in Baden-Wuerttemberg. As a typical feature no special CAS is prescribed; schools can work with a portable computer or with a PC of their choice. In several fields we have to gain experiences now: Methodics of CA use in the classroom, construction of questions for the central examinations, organization of a computer based central exam and financing the calculators or the software. In several teachers' training courses a survey of the usual CA systems was given. Special courses concerning the use of Derive and of the TI-92/89 were offered afterwards. We are now in the process of developing and testing exams for CA aided mathematics.

At the Landesinstitut für Erziehung und Unterricht in Stuttgart we are concerned with questions of syllabus development, teachers' training etc. CA systems are going to make their way into the syllabi - even in schools with a central exam. CAS courses in Computer Science, called "Datenverarbeitung" at our schools have been held for a couple of years already. Just now at some of our schools verbal exams aided by CAS have been held, partially with astonishingly good results.

We feel that especially in addition to the obligatory math courses each pupil has to attend, CAS can play an important role in the classroom and at home. It was well recognized from the beginning that CAS should belong in the math syllabus; it was equally felt, however, that it would be a long way to that end. From the experiences we have made up to now, it is felt e.g. that the same teacher should present the math and the CAS course. The usual proceeding is as follows: After getting accustomed to the handling of one CA system - on a pocket computer or PC based - pupils use it from the

beginning of “Klasse 11” or “Klasse 12” for solving equations and systems, investigating graphs of functions, modelling real situations and later on for the routine work in calculus, linear algebra and their applications.

Let me mention a concurrent project in the “Allgemein bildendes Gymnasium” based on a different concept than ours. PIMOKL means “Pilotprojekt Mobiles Klassenzimmer”. In the beginning in 1996 a group of math teachers (Wolfgang Henn, Werner Jock, Dieter Koller, and Rolf Reimer) from the “Staatliches Seminar für Schulpädagogik (Gymnasien) Karlsruhe” began a study with 4 teams of “Klasse 11” which was continued in “Klasse 12” and “Klasse 13” and was culminating in an “Abiturprüfung” with CAS. The courses followed the usual syllabus; the new possibilities of Maple, however, in connection with a notebook available in each math lesson and permanently at home were evaluated and in due course led to a new accentuation of several topics. Maple permits a concept of worksheets with text, calculations, and graphics altogether.

There has been a really good cooperation between our groups. It is agreed upon that the use of CAS should not lead to more calculating but should set free an appropriate amount time for reasoning, modelling, problem solving, i.e. for *new questions*. We feel, however, that the notebook concept cannot be transferred to many schools in a reasonably short time. The vocational schools therefore tend to establish the use of *any* kind of CA system in the classroom and in the examination. Derive e.g. is not an appropriate tool for establishing the worksheet concept, nor is it the TI or CASIO calculator. Our actual tendency is keeping the traditional pencil and paper approach and using the CAS as a mathematical tool, perhaps an assistant only, but not as a substitute for writing down the calculations, sketching the graphs etc.

We are convinced that information about the use of CAS and at least a basic knowledge of the available systems is absolutely necessary for anyone working successfully in this field. Thus, in a first conference at our teachers' training academy ALF in Esslingen, Derive, the TI-9x series, a CASIO handheld computer, Maple and MuPad were presented to the participants. They could work with all of the systems, compare them and ask for further information. At another conference so called "CAS-Pilotaufgaben" were developed and made available to the schools. We plan to continue this series of pilot questions.

Any kind of a central exam can be regarded in two ways: A continuous standard is maintained, every teacher is required to comply to it - so a uniform quality of the examination is assured. On the other hand, it is rather difficult to introduce a new kind of questions into these exams, because a certain amount of standardisation is achieved in the long run. The TIMS study points at some deficiencies in the fields of modelling, problem solving in general, and confirms the competence of our pupils with tasks like the "Kurvendiskussion", the handling of "Lineare Gleichungssysteme" etc. We can conclude from these studies that at least a small change of paradigms is overdue. Will CAS help us in achieving this goal? The main point in my own opinion is building up in reasonable time a set of appropriate questions to be distributed among the teachers. What kind of questions will be encouraged? Certainly the amount of pure calculation should be reduced in favour of e.g. finding functions to a given graph, finding problems to given solutions, answering questions like "How would you ...", "What would be if ...", "Why is it that ...". Verbalizing results and the chain of arguments leading to them should gain more weight than before.

There is still a lot of problems to be solved:

1. The use of a CA system is at first a question of availability - not of the system itself, but of the means to buy it. Many of the parents of our pupils are not willing to accept a price of about DM 300,-- for a pocket calculator. Many schools are not willing or not able to buy the necessary amount of PC for Derive, Maple e.g.
2. Teachers, even if they are willing to use these new instruments, must be trained. The degree of CAS competence expected of them is not yet defined precisely.
3. We should investigate if a two-tier examination is a good way of achieving our goals - using the new possibilities of technology but at the same hand assuring that the necessary basic skills in handling mathematical problems are maintained.