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ABSTRACT

This paper describes several projects concerning the use of the DERIVE programming language for symbolic computation in Slovenia. The main topics discussed include preparing books and materials using DERIVE in Slovenian language, and a survey on the use of programs for symbolic computation by mathematics teachers in Slovenian secondary schools. (Contains 15 references.) (KHR)

DERIVE IN SLOVENIAN SCHOOLS

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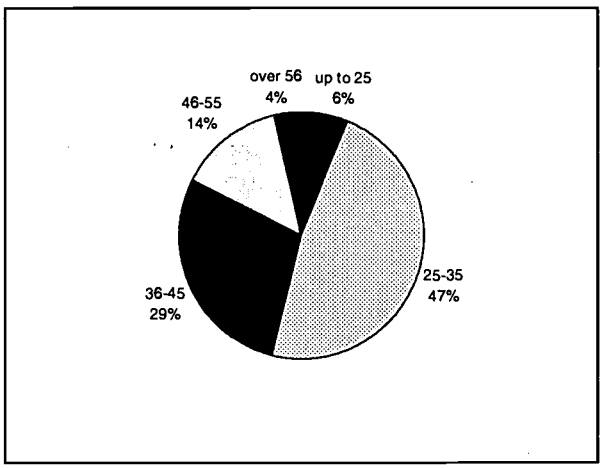
DERIVE has been present in Slovenian secondary schools for several years. First organized efforts date back to 1990, when we started with some seminars and demonstrations on DERIVE. In the next year all secondary schools received copies of the program. Unfortunately, due to lack of institutional support there has not been a lot of coordinated activities. So most of the work remained isolated between some enthusiasts. Many of secondary school teachers of mathematics, physics and to mathematics related curricula are still not aware of DERIVE and similar programs for symbolic computation. As it is a well known fact that symbolic algebra packages have great influence on the way mathematics in taught and used in the classrooms, it is necessary for all teachers to get in touch with such packages.

In 1995 Slovenia started a big project on use of computers in education, called Computing Literacy. Its main goal is to encourage the computer use in Slovenian education. As a part of this project DERIVE has been in 1997 chosen as a program in so called "basket of didactical programs". So every school in Slovenia can obtain program under special price. But that is not enough. To encourage the use of programs for symbolic computation, we started several projects about usage of DERIVE. Two projects were on establishing a library of Classroom activities with DERIVE. We prepared materials covering various themes and in various forms: as a preparation for a lecture; as Utility files with instructions for its use; as laboratory sheets; ... During this last two years of activity in this field we prepared over a hundred such themes. We are still looking for the best way to disseminate such material among all teachers. We are preparing WWW server with this material (unfortunately still in very rough form on HTTP://WWW.EDUCA.FMF.UNI-LJ.SI/WWWDERIVE/), but many of the teachers think that the best way would be to publish the material in printed form. A study in which the use of this material will be tracked and their impact on the knowledge of students studied is being prepared with the hope to start it as soon as possible.

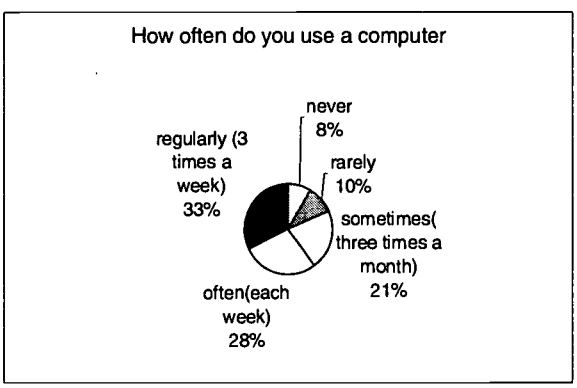
Another project was a study to determine if it is meaningful to translate DERIVE in Slovenian language. With new "incarnations" of DERIVE in Windows and in TI-92, the answer is probably no. Another effort to encourage the usage of programs for symbolic computation is a specially prepared lecture in which we demonstrate the ways in which symbolic computation can be used in the classroom. We will try to present this lecture to all teachers of mathematics in Slovenian secondary schools, mostly to encourage the thinking about the impact programs for symbolic computation have on the way we teach mathematics. We are also preparing several books on DERIVE. There is a lot of similar

material, but mostly in English. So we prepared our own material in Slovenian language and connected to our curriculum.

As part of our activities we mailed the questionnaire about usage of programs for symbolic computation to all teachers of mathematics in Slovenian secondary schools. We received almost 300 replies; enough to make some conclusions, as it is estimated there are not more than 500 teachers. The questions can be divided into several categories. In the first one we were interested in general data about the teachers – their age and years of experience as a teacher. We found out that we have quite young teachers, namely almost half of the answers were in the group of 25 – 35 years old, especially when we connect this data with the fact that 1/3 have less then 5 years of teaching experience.

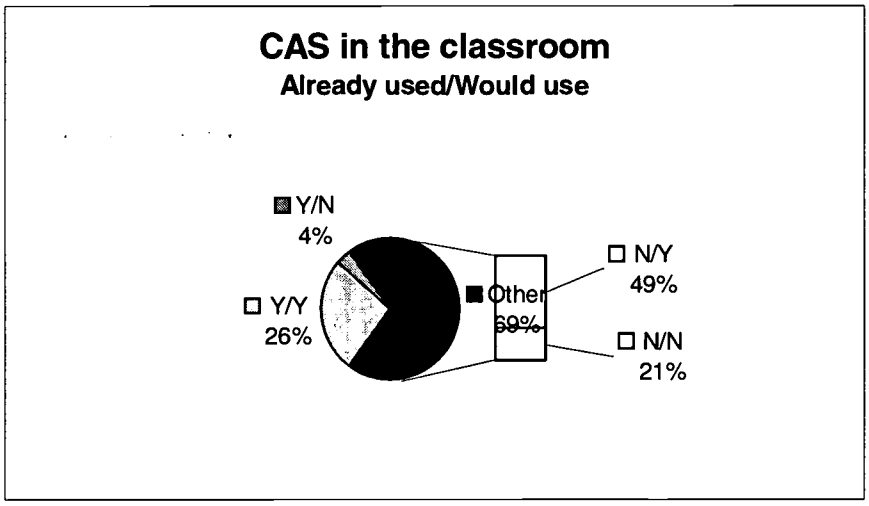


In the second part there were questions about the general use of computers and the level of necessary computing equipment in the schools. There is a strong evidence about ongoing project Computing Literacy which contributes a lot of funding for computer equipment (hardware and software) and computer education. As already mentioned, starting this year Derive is the part of "basket of secondary schools software". So, teachers are quite well equipped with computers and are using them. About 81% of respondents have a computer at home and less then 1/5th are not using them or rarely.



We also asked question about the possibility of usage of a computer for their work at schools or in the classroom. More then 3/4 have access to the computer at school, but only 40% can use the specialized computing room (with at least 8 computers) and almost 60% responded that it is not possible to use the computer in their math classroom. About the same percentage also claim that their school does not have equipment for displaying computer screen.

About 80% teachers have already (30%) or wish to (49%) use Computer algebra systems (CAS) in the classroom. Just 4% of those who already have that experience do not want to do that again.



The third part of questionnaire consisted of questions about various computer algebra systems and howe teachers feel about using them in the classrooms and at the exems. It should be noted that almost without exception all computers used in our secondary schools are PC compatibles.

64% of the teachers claim to know what programs for symbolic computation are. 90% have heard about Derive, 78% about Mathematica, 40% about MathCAD, 28% about Cabri Geometre and 13% have heard about Maple. Actual use of this programs is, as was expected, a lot lower. 64% have already used Derive, 28% Mathematica, 10% MathCAD and Cabri Geometre and just1% (3 respondents) have tried Maple.

When we asked them how they feel about usage of CAS in the classroom, the majority of answers were do not know enough. Just these question alone show the necessity of education of mathematical teachers in the field of CAS. This percentage should be much lower! Happily only about 17% are categorically against CAS's in the classrooms.

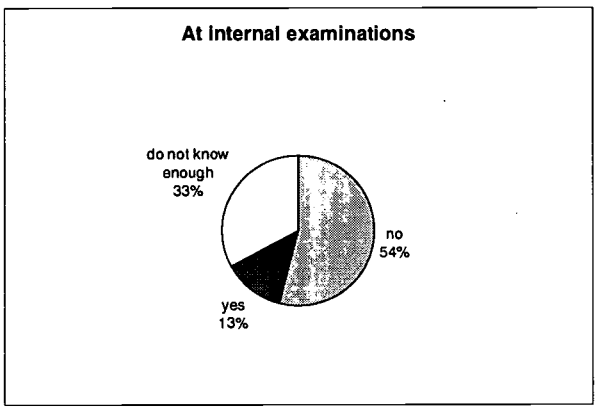
Should we use CAS in the classroom

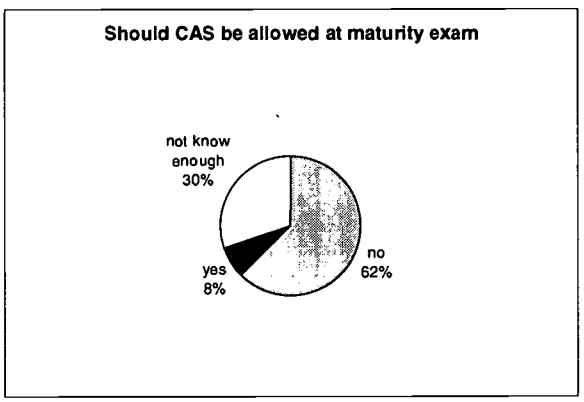
Yes	113	40,79%
No	46	16,61%
Do not know enough	118	42,60%

We got about the same picture from the question *Should methods requiring CAS be introduced in curriculum and teaching books.*

Should we introduce CAS in the curriculum		
Yes	116	33,57%
No	68	24,55%
Not know enough	93	41,88%

There were also two questions about the use of CAS at the exams. The majority think CAS should not be used neither at internal nor at final examination (which is an external one).

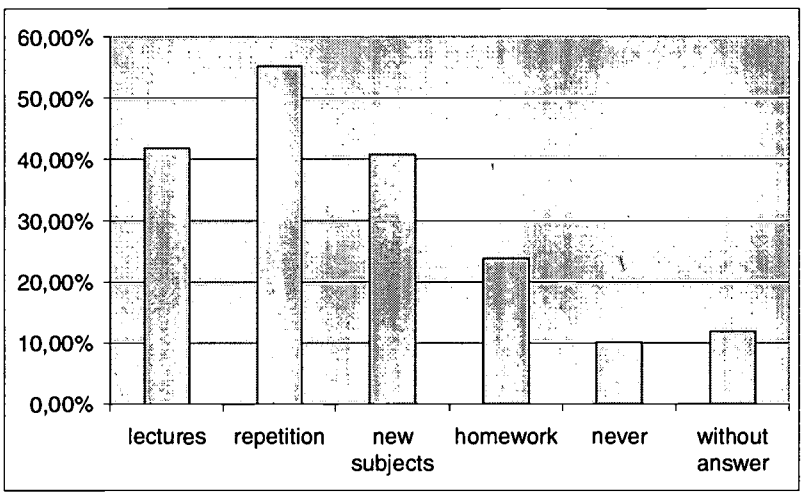




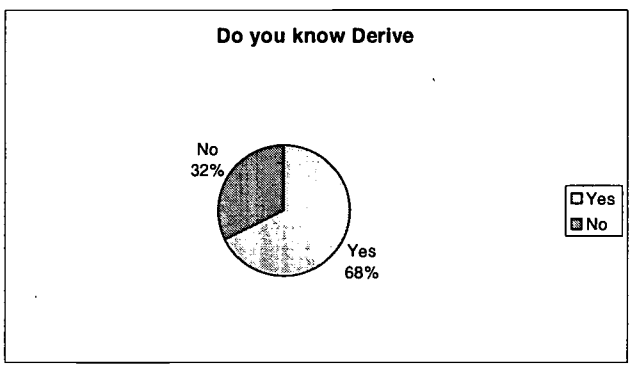
On the question whether there are subjects in curriculum which should be taught as "black boxes", all three possible answers (Yes, No, Do not know enough) received about 1/3 of the replies. We asked those who responded "yes", to name a few. Among them were:

trigonometric functions, bisection, various methods for equation solving, producing a graph of the function, calculating roots, solving systems of linear equations, calculating with logarithms,...

We also asked them to tell how after they would use programs for symbolic computation. Possible answers with proposed usage of equipment were never, at lectures (one computer with projector), at repetition (one computer with or without projector), as homework (pupils work on their own), or when new subject is taught (computer laboratory). Several answers were possible.



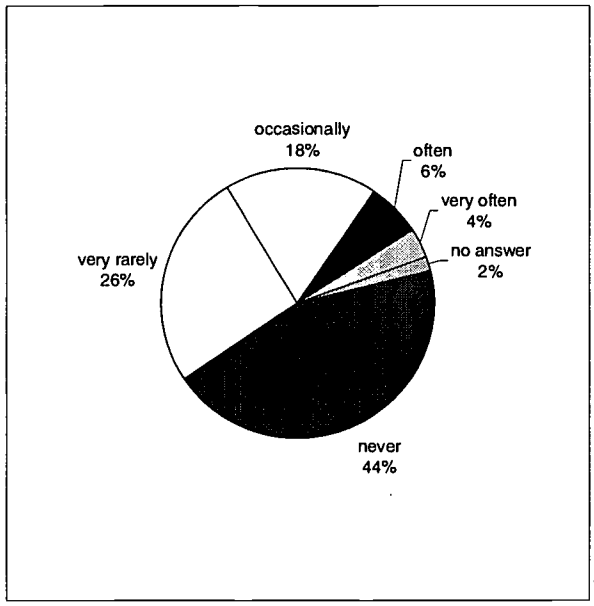
In the last part of the questionnaire we were interested in their usage of Derive. As can be seen from the chart bellow,



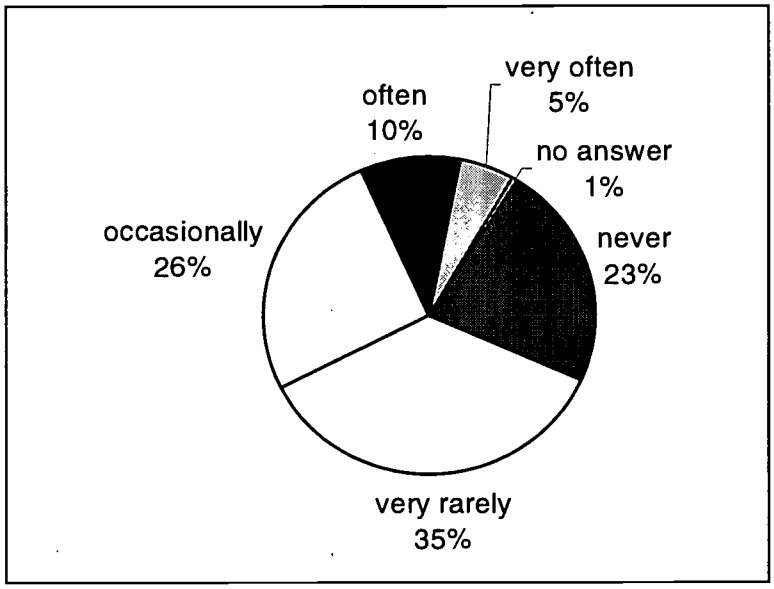
68% of teachers claim to know Derive. Compared to 90% of those who have heard of this program, we still have 22% whose "knowledge" about Derive is limited just to know the existence of the program.
In the next chart we see how long our teachers know Derive

How long I know Derive		
No answer	9	3,25%
I do not know it	78	28,16%
Less than a year	11	3,97%
1 to 3 years	52	18,77%
3-5 years	74	26,71%
More than 5 years	53	19,13%

So teachers are already quite familiar with Derive. But how often do they use it?

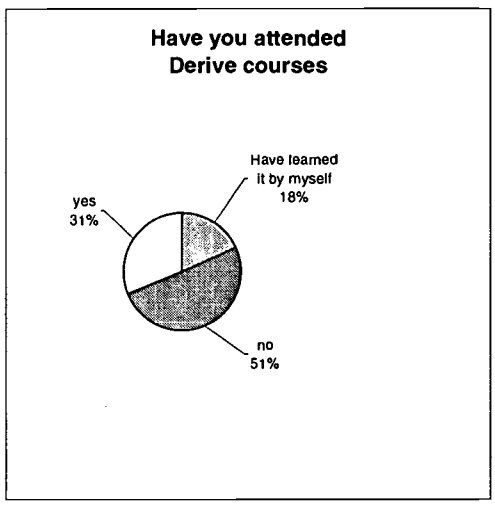


Well, if we count only those who know Derive, a situation is a little better. But it is still evident that Derive is not very often used in the classroom. And due to the data about knowledge of other programs, we can assume the same to be true for all CAS.

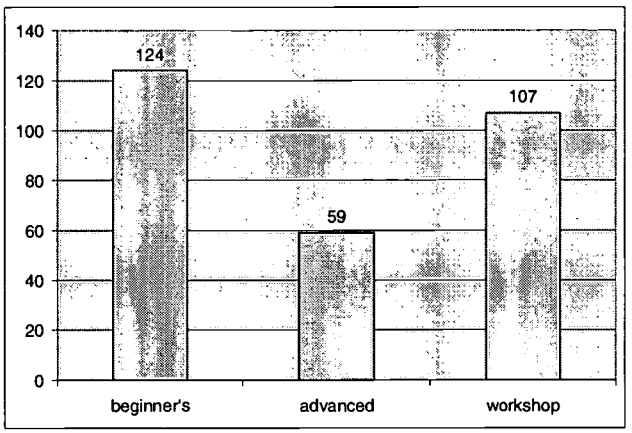


So our teachers do know Derive, but only one half of them who know it are actually using it. Probably the reason is, as some remarks on questionnaire tell, the lack of suitable training and especially literature and courseware.

Quite a lot of teachers (almost one third) already attended various courses about the usage of the Derive during last 6 years. But due to the lack of suitable materials, they have heard mostly about Derive itself – manipulation with the program. Also one of our goals is also to rise this percentage to majority of math teachers. They should know the program to participate in reasonable decisions about the usage of CAS in the math curricula.



As we plan to introduce several courses on various levels (beginner's course, advanced course, and workshops on preparing classroom materials), we asked them to express their wish to attend these courses:



So, in the forthcoming year, we already have a very numerous audience for courses – namely almost all teachers wish to attend one or more course. To be precise, only about 12% did not express any wishes towards such education. A lot of work to do!
Due to this fact our main activity now is to prepare a group of teachers who will act as instructors on this courses. They will also be presenters of the before mentioned lecture *Using programs for symbolic computation in secondary math classes.* During this preparation we are writing a courseware for these courses, as well as try to broaden the knowledge of Derive between these instructors. We established connections with colleges who decided to participate in European T^3 project, where Derive and especially TI-92 is heavily involved. They have already suggested to rewrite our written materials in the form TI-92 users can use them too.
All our effort will be fruitful if teachers of mathematics will be suitable prepared, not for answers but at least for discussion on the principal question – When, why and how to use computer algebra systems in teaching of mathematics.

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