Adults Learning Maths Newsletter

No. 13
May 2001

From the Chair

It is that time year already when members are once again turning their attention to the business of the annual conference. This year as you know Roskilde University in Denmark is the venue for our conference and annual general meeting (AGM). You can find details elsewhere in this issue of the newsletter or at the ALM website. By way of preparation I would like to urge all members to give serious thought as to how we can better advance the objects of the association. Papers for the AGM will be circulated to all members in good time for the meeting.

While it is desirable to have input across a range of issues that affect members, the trustees are especially interested in members' ideas and views on: ALM publications e.g. newsletter, books, journal; website and how it might be improved/expanded; ways of involving/reaching more practitioners, and generally streamlining our operation. Members are invited to make their views known at the AGM in person or by writing or emailing a trustee or myself who will bring their views to the meeting. For example, I am keen to add an extended list of members publications on adults learning mathematics to the website. What would you like to see done?

Before I sign off I would like to congratulate the editorial team on the quality of the newsletter and for all their splendid work during the year. I know it is much appreciated by all associated with ALM.

Finally, let me remind members to send in their booking forms for ALM-8 if they have not done so. I look forward to seeing all of you at ALM-8 in Roskilde in June.

Prof John O'Donoghue, Chair ALM
Dept of Mathematics and Statistics
University of Limerick, Limerick, Ireland.
Fax: +353 61 334927 email: John.ODonoghue@ul.ie

In this issue

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Mathematics and key skills for the workplace

Henk van der Kooij, Freudenthal Institute, Utrecht University, The Netherlands.

In the TWIN-project, a new mathematics program is being developed for initial vocational education (engineering) for students in the age group 16-20. Learning mathematics that makes sense in professional life is quite different from learning it just because of the discipline itself. In the TWIN project higher order (qualitative) skills are emphasized more than basic (algorithmic) skills. During the project, both the organization and the general goals of vocational education in the Netherlands began to change. In the past, qualifications for the workplace were described in detailed, merely factual knowledge of individual subjects. The (political) discussion is now focused on the learning of core competencies for the workplace. The description of these competencies should be the driving force for vocational education. There is a big challenge for mathematics education in this context: are we able to define mathematical programs for vocational education in which competencies and skills are learned that fit the broader and more general core competencies for the workplace?

The TWIN project: useful mathematics for Engineering

Over the years 1996-2000 the TWIN project was carried out in the Netherlands. TWIN stands for **T**echniek (engineering), **W**iskunde (mathematics), **I**nformation Technology, **N**atuurkunde (Physics). The aim of the project was to design for upper secondary vocational engineering courses a new program for mathematics (and physics) that really supports the vocational subjects of study and later practice, accepts the mathematical weakness of students (especially in formal algebra) and integrates the use of IT tools in both the learning process and assessment.

Realistic Mathematics Education

The theory of Realistic Mathematics Education (RME) will be briefly described because the mathematics part of the project was carried out by the Freudenthal Institute, where RME is the major frame of reference in mathematics education..

In the early seventies of the past century Freudenthal introduced a new approach to mathematics education. He claimed that the traditional way of teaching mathematics,

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where the starting point is within the formal abstract mathematical system, is anti-didactic (Freudenthal, 1973). Instead of starting at the very end the formal system, students should be given the opportunity to re-invent and re-construct mathematical concepts starting from a concrete, intuitive level. In the realistic view, the development of a concept begins with an intuitive exploration by the students, guided by the teacher and the instructional materials, with enough room for students to develop and use their own informal strategies to attack problems. From there on the learning trajectory leads, via structuring-, abstracting- and generalizing activities, to the formalization of the concept. Contextual problems, both real world problems and realistic problems in the field of mathematics itself, are very important in the RME approach. They serve as the starting point for the development of a concept as well as the source for applications and refinements of the mathematical concept (Van der Kooij, 1999).

In RME, when a new mathematical concept is introduced students are given enough space to work on a concrete, informal level. At this stage of the learning process students develop and use own strategies for solving problems that are offered within a context. It is frequently observed that, in this informal stage, strategies used by students are different from the ones that well-trained mathematicians normally use. Students try to solve a stated problem and use the given context as a basis for their calculations and reasoning, where most mathematicians will first de-contextualize the problem and then use the formal system of mathematics to find an answer. Therefore, student's personal strategies are a good basis for further learning and teaching activities.

Useful mathematics for engineering

Answers to the important question about what mathematical subjects are important for vocational practice, were found by working through vocational textbooks and by discussing the question with vocational trainers. It was interesting to see that most vocational trainers were not aware of new ideas about the use and teaching of mathematics. Most of them use standard mathematical routines, usually algebraic algorithms, that they learned themselves a long time ago. Topics that are not included in (Dutch) general mathematics education, but that have importance for engineering are:

- Functions, as relationships between Entities, with Dimensions and Units
- Proportionality, both direct and inverse
- Reading and interpreting complex graphs
- Logarithmic Scales on graphs.

One example from the TWIN student materials shows all four topics at the same time. The first one is about biking and shows a family of graphs that visualize the relationship $v = 0.06 \cdot p \cdot g$

Four *v*-*g* diagrams are drawn for different values of *p*.

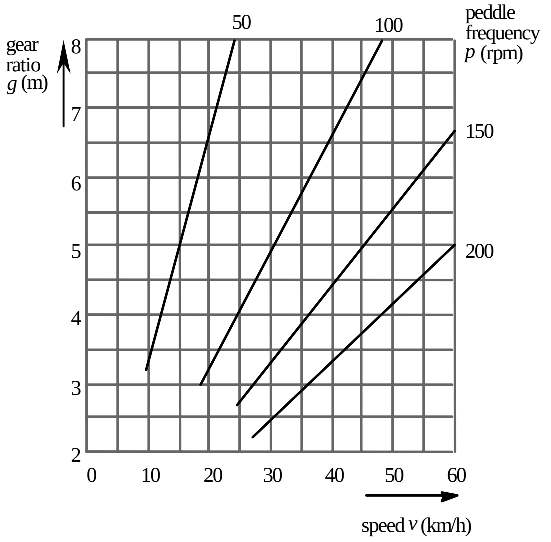

Figure 1: Bike curves

The second picture shows graphs of the relationship $v = p \cdot n \cdot d$ in *d*-*v* diagrams for several values of *n*. This formula describes the relationship for a lathe between rotational speed of the piece of work and the cutting speed of the knife.

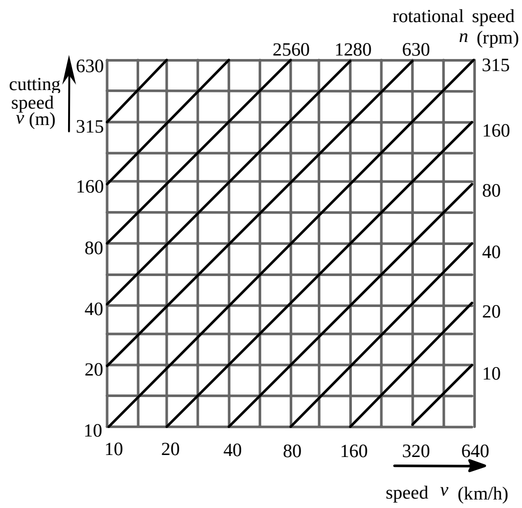

Figure 2: Lathe curves

The formulas have exactly the same structure, so the graphs should be similar. However, due to the scaling of the axes (logarithmic) in figure 2, the graphs are parallel lines instead of a set of straight lines going through the origin as in figure 1. For mathematicians these pictures are very uncommon and appear to be not mathematically correct: the numbers are not exact and the origin is missing. That's why these kinds of graphs never appeared in (Dutch) mathematics textbooks and are not the subject of study in regular mathematics courses. But these kinds of diagrams are the reality in many situations in vocational practice. Both graphs and formulas were found in vocational textbooks. This is how mathematical topics are presented most of the time and that is what vocational students should be prepared for: to be able to critically analyze the information of occupational practice using mathematical tools. A dimensional analysis clarifies the meaning of the formulas and explains the constant factors 0.06 and p (including the mistake in the second formula!).

Paying attention to dimensions and the contextual meaning of numbers is something that is ignored in most mathematics educational programs. But they cannot be ignored in the vocational practice of engineering students.

This contrasts with mathematicians who are very well trained in handling value-free numbers as if they are entities in themselves, but most users of mathematics are actually using numbers as values for (physical) entities. Most of the time, they use the context of the problem as a kind of reasoning base for their calculations. The context of the problem that has to be solved is used as a guide for the way in which they choose their solving strategy. In general, these strategies are not easily translated into an algorithm that can be used to solve similar problems in different contexts.

One of the important claims of Realistic Mathematics Education (De Lange, 1987; Gravemeijer, 1994), is that mathematical concepts should first be explored in (a number of different) contexts and after that generalized and formalized into the world of (abstract) mathematics. However, it was found in the TWIN project that most of the time this full abstraction is a step not required for students in vocational education. Because of the way in which mathematical methods are used in occupational practice, this full abstraction is not necessary. This is in accordance with findings of Hoyles and Noss (Hoyles & Noss, 1998): practitioners at work use *situated abstraction* in which they use some kind of local mathematical models and ideas that are only partly valid in a different context because they are connected to *anchors* within the context of the problem itself. Therefore, transfer of procedures to comparable situations seems more important than generalization and abstraction into the formal, abstract world of mathematics. Most of the time, this transfer is not complete in the way that every context gives rise to its own modification of the method.

Algebra: pure or real?

An important finding of the TWIN project is that it makes sense for mathematics educators and curriculum developers to think of two different ways of using algebra. First, the way of the mathematician, who handles numbers and relationships between sets of numbers as if numbers are existing objects. In that world standard routines and algorithms make sense and have value in itself. Secondly, in the real world of applications to (physical) entities, algebra is used by practitioners in a mixture of context bound strategies and rules from the discipline of mathematics.

For vocational practice it seems much more important to strengthen the abilities of students to use these situated strategies in a flexible way than to force them into the very strict rules of standard algorithmic skills of 'pure' algebra. Of course, algebra cannot be ignored completely when solving more complex problems, but it was accepted in the project that most students are poor in this field of mathematics. For that reason the use of the graphing calculator (TI 83) was introduced into the program, to help students cope with sophisticated algebraic manipulations.

The following example illustrates this use of the graphing calculator.

In electronics, two sinusoidal signals have to be added and the question is what formula describes the sum of the signals. It takes a lot of algebra to arrive at the solution. In traditional textbooks, a lot of additional mathematics has to be developed just to find this desired formula. The graphing calculator (GC) can replace a lot of such algebra work (figure 3).

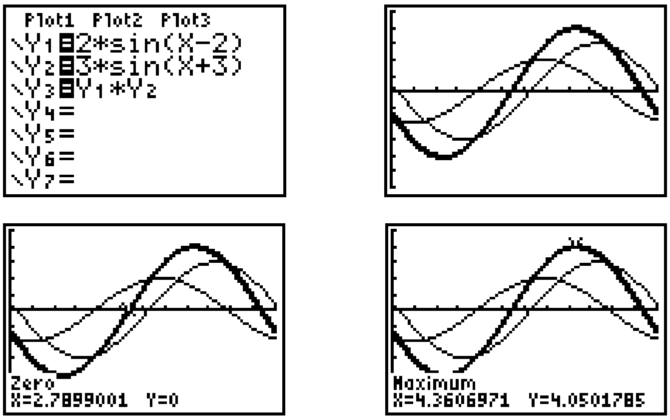

Figure 3: Adding two sinusoids to get a new one

The screens show that $y = 2 \cdot \sin(x-2) + 3 \cdot \sin(x+3)$ is again a sinusoid with the same period. The formula for the sum is $y = 4.05 \cdot \sin(x-2.79)$.

The GC does not completely solve the problem for the student. It only calculates some information that can be used to find the formula (like zeros and extreme values). So, in fact the GC is a tool that does the basic computational work. Finding the formula for the sum with these numbers expects the students to be familiar with the key characteristics of the sinusoid: the amplitude, the period and the horizontal shift (Van der Kooij, 2000).

Mathematical skills on different levels

As a consequence of its aims, it was no longer appropriate to describe the attainment targets for the new program only on the level of basic technical knowledge, like it was done in previous programs. Therefore, a new set of attainment targets on three levels was developed.

Some examples are :

Level 1. General skills: a student can

- recognize which mathematical methods are available and appropriate to describe, analyze and solve a given problem in an engineering context

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Mathematics and key skills *continued from page 3*

- recognize where and why IT tools (software packages, GC) can be used to analyze a contextual problem
- communicate the strategy that is used to attack a problem.

Level 2. General mathematical skills: a student can
- use mathematical methods in a correct way, with a good notion of accuracy and limitations.
- can use geometrical methods to solve an algebraic problem (if possible) and vice versa
- can use IT tools in an appropriate way.

Level 3. Technical mathematical skills. A student knows
- the standard functions, including the graphs
- how a transformation on the graph of a standard function influences the formula of the function and the other way around
- how to read and interpret graphs with logarithmic scales.

In fact levels 2 and 3 are subordinate to the first one. One of the consequences is that basic skills should only be learned and taught as far as they fit in the 'context' of the general goals.

These attainment targets are comparable to the three levels of mathematical competency that are described in the OECD/PISA document "Measuring Student Knowledge and Skills, A New Framework for Assessment" (OECD, 1999). Mathematical literacy is described through eight competencies: Mathematical thinking skill, Mathematical argumentation skill, Modelling skill, Problem posing and solving skill, Representation skill, Symbolic, formal and technical skill, Communication skill, Aids and tools skill.

These eight competencies should not be assessed individually, but should ideally be present in every assessment item. The assessment items are organised in three classes of competencies: reproduction, definitions and computations (class 1), connections and integration for problem solving (class 2) and mathematical thinking, generalisation and insight (class 3).

The goal of OECD/PISA is

> "*to assess the full breadth of student achievement in a coherent, integrated way, rather than to test fragmented pieces of factual knowledge, which belongs to Competency Class 1. Interconnections and common ideas are central elements. Mathematics is the language that describes patterns, both patterns in nature and patterns invented by the human mind. In order to be mathematically literate, students must recognise these patterns and see their variety, regularity and interconnections. For that reason, the content to be assessed is organised around big mathematical ideas instead of the traditional content strands… The big ideas that are chosen are: chance, change and growth, space and shape, quantitative reasoning, uncertainty, dependency and relationships.*"

Although the PISA project will assess 15-years old in general education, the ideas of the framework can be used as a good basis for defining mathematical competencies and skills for vocational education and for the workplace.

Mathematical competencies for the workplace (and therefore for vocational education) should be defined in terms of the ability of students to describe and solve occupational problems with the use of appropriate mathematical methods. These methods should first be described in general terms of higher order skills, and then specified in more basic, technical skills. In the TWIN project we have tried to design a program that fits these demands.

Competencies for the workplace and vocational education

In The Netherlands, initial vocational training is organized through so-called Regional Education Centres. Students (age 16-20) are preparing for middle level management jobs after finishing lower secondary general or vocational education (age 12-16). The definition and description of qualifications for the workplace are changing very fast. The most important reason for this ongoing change is the influence of automation on many processes, mainly in industrial and administrative jobs. This changes the demands of the workplace for people who are differently educated. Factual knowledge about handling tools that are used in the workplace now is no longer an important goal for learning. By the time that the students arrive in the workplace, these tools are outdated and replaced by new , more sophisticated ones. More important are the development of methodical competencies (like planning and problem solving) in which the triad product, process and problem of the workplace is the main goal for learning. In traditional vocational training programs, qualifications were described for each individual, isolated subject that was taught in terms of the detailed factual knowledge a student should master. The description of the qualifications is drastically changed by the introduction of key competencies for the workplace. There is a shift from detailed descriptions of basic skills to the description of more general attitudes, needed to become a useful member of a workplace-community.

In an analysis of the complexity of the workplace, Onstenk (2000) describes the competencies for a practitioner that are needed to handle core occupational problems. This description of the competencies should be the driving force for vocational education.

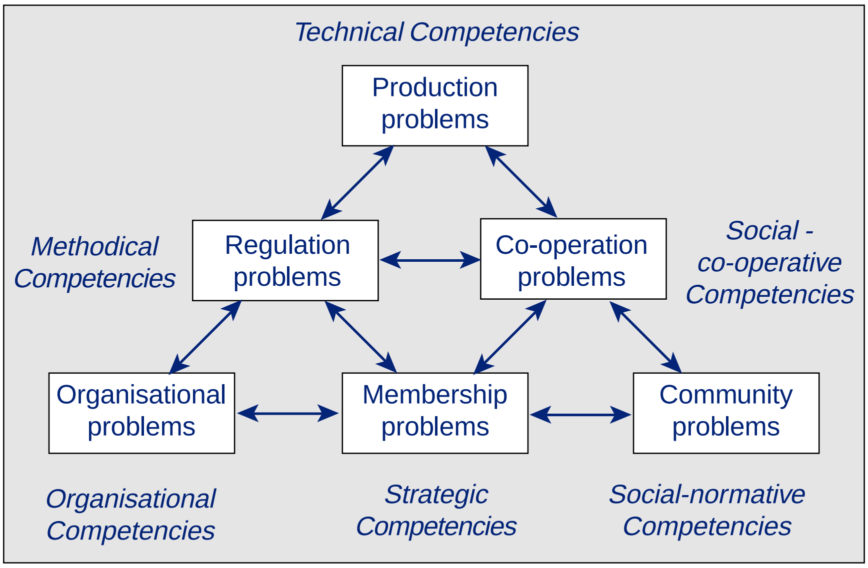

Figure 4: Competencies and key problems in the workplace

> *Broad occupational or professional competency is defined as a multi-dimensional, structured and internally connected set of occupational technical, methodical, organisational, strategic, co-operative and socio-communicative competencies, geared to an adequate approach to the core problems of the occupation.*
>
> *In order to respond to the need to change, to participate in and contribute to innovation and to acquire new competencies 'learning and shaping competencies' are added as necessary elements in broad professional skills. This analysis has been accepted by the Dutch Advisory Committee for the qualification structure (ACOA) which makes core competencies the central element in both occupational and qualification profiles, aiming at improvement of vocational education as a preparation for the demands in actual occupational practice. A consensus is reached in the Netherlands on the need and usefulness of a clear qualification structure, based on occupational profiles that are legitimized by social partners.*
>
> *There is also consensus on the need for the development of broad vocational education, both with regard to a range of occupations and with regard to a threefold qualification: for an occupation, for further (vocational) education and for citizenship.*

It is clear from this description that qualifications for the workplace are no longer described in detailed segments of factual knowledge, but only in general terms of attitudes and so-called higher order skills. Vocational education should re-organize its training programs to fulfil these demands. One of the great challenges in this new concept of vocational education is to get a clear view about how individual subjects can be brought together or even be integrated in such a way that they contribute to the development of the desired competencies. In particular, both contents and didactics of general subjects like mathematics, science and language should be reconsidered to make these subjects really add to the development of the competencies. One thing is clear: mathematics and science are no longer important in itself. The traditional courses of mathematics and science are doomed to disappear from the vocational programs in these newly defined qualification structures, because they were never described in terms of applicability in occupational practice.

Mathematical Competencies for the Workplace

Mathematics education needs to be reconsidered in the light of competencies-driven vocational training. The learning of mathematics should not zoom in on algorithmic, routine training of merely factual knowledge (a consequence of the view on mathematics as the science of number and form), but it should emphasize the view of mathematics as the science of pattern and structure. This last view is more easily connected to the learning of, partly individual- and culture based, useful mathematical tools and strategies to attack problems that stem from outside the discipline itself: real-life and workplace problems.

The newly defined competencies for vocational training do not mention any specific mathematical (basic) skills. But in the general descriptions, expressions can be found like: is able to schematize, to organize, to critically reflect on. Very specific training in algorithmic mathematical basic skills does not add very much to these competencies. But qualitative reasoning in the context of a situated problem and trying to generalize context-bound strategies are important skills. Mathematics education can really add to the competencies for the workplace. The needed mathematical skills are quite different from the skills that we trained students for in the past: not algorithmic rules for its own sake, but a critical way of using situated abstractions and the ability to transfer strategies to other contexts, where they are valid.

A mathematics program (closely connected to or even integrated in vocational courses) that

- tries to make students flexible in the use of different strategies, including the use of technology, instead of making them use one (formal) technique
- uses the real-world contexts of their field of interest (engineering) to learn mathematical concepts and to develop a mathematical attitude

can indeed be useful for the preparation of future workers, ready to function in an ever changing world of work. The design of the TWIN program was a first step in the right direction. But it will take time and energy to incorporate the program into the new structure and organization of Dutch vocational education.

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This article is based on a paper that was presented to WGA6 at ICME9 (Tokyo, 2000) and the workshop of Tom Goris and Henk van der Kooij at ALM7 (Boston, 2000)

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Henk van der Kooij, <henk@fi.uu.nl>

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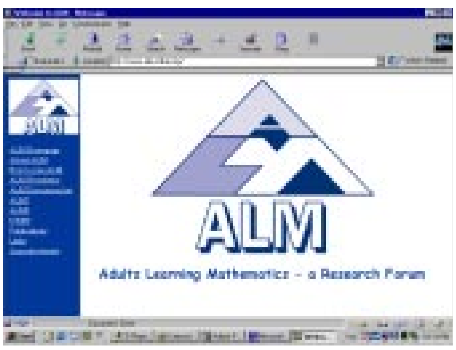


ALM members are invited to send information about their publications for announcement on the ALM website.

The KAM project

A project funded by The Swedish National Agency of Education

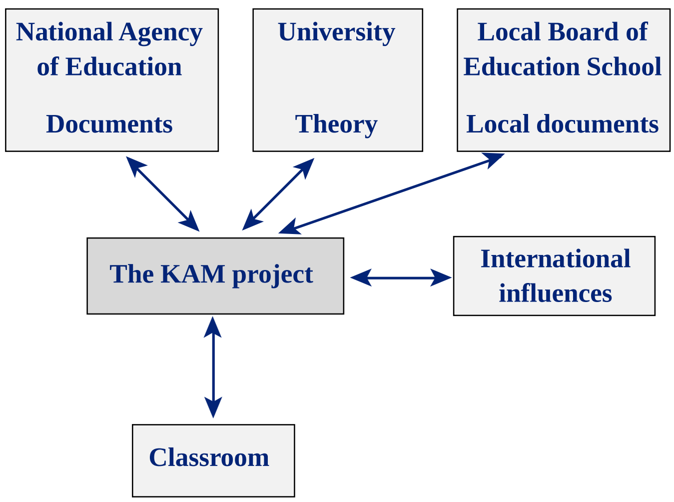
Leif Maerker, Bräcke Upper Seconday School, Goteborg, Sweden.

The KAM project is school-based and has its main focus on studying the relationship between mathematics and vocational subjects. Part of this is to improve and develop mathematical models that are relevant and applicable, and to produce teaching material to support them. The project emphasizes changes in the approach to learning, teaching and assessing with focus on using integration whilst still keeping a door open for further education and the more formal side of mathematics.

Nearly all Swedes aged 16 and up go to Upper Secondary School. Many who study in vocational programs fail in the mathematics course. A recent change in the Swedish Curriculum for upper secondary schools resulted in a change that supports the KAM project, but a curriculum change alone is not a guarantee that teaching will change in the classroom.

To achieve such a change, we need to analyse what kind of mathematics is needed in various vocational programs as well as how this mathematics should be taught, in order to create a useful and understandable tool for students in their vocational training that can also serve as a tool for lifelong learning. Teaching material should be produced to support the teachers. Vocational and mathematics teachers need instruction in integrating teaching so that students see their education as a whole and so that obstacles such as differences in teaching traditions and views on knowledge are overcome.

Project Design: To build bridges between theory and practice and facilitate the development for reaching most classrooms as soon as possible:



New curriculum

Since 1994 vocational programs are included in Swedish upper secondary schools. In these programs all students have to study approximately 100 hours of mathematics (course A) after their previous 900 hours in the compulsory school system. Today the demands from society and workplaces are harder, and to meet some of those demands, course A is made compulsory. This means that it has the same mathematical content for all programs

Student related problems

Currently a large number of students who attend the vocational and trade streams in the upper secondary school fail mathematics. Nearly 50 % of the students fail on the national mathematics tests in the course (Course A) and up to 70 % on the mechanics' program, a very intensive mathematics program. Moreover, many students who leave after 9 years in compulsory school, do not have the mathematical knowledge that they are supposed to have.

The students' attitude can be summarised in the following lines from Hill: "In the vocational subject, even in the parts that were theoretical, they felt motivated most of the time. In the "core subjects" they said, a bit surprisedly, that they recognised most of it. The contents, the methods and… the boredom" (translated from Hill, 1999)

Today nearly all Swedish students go to upper secondary school. For many of the teachers this category of low achieving students was new. The teachers lack support to handle the students and their mathematical problems.

Although Official statistics show that nearly 50 % of the students in vocational education fail in the national test , half of these students eventually get "passed" anyway. In combination with other reports, this can be seen as a dangerous trend for the students in the long run.

We know too from experience that teachers want to change their teaching because of concern for their students, but they need help from in service training and textbooks. The KAM project aims to do this.

Teacher related problems

In traditional vocational programs the learners are taught mathematics by an academically trained teacher and sometimes, in the vocational course, by an autodidact. This might be a problem. The mathematics teacher does not know what kind of mathematical contents the student needs in the vocational course and the vocational teacher has very little or limited knowledge of mathematics and didactics (teaching??) of mathematics. The vocational teacher has never been trained to teach mathematics, whereas the mathematics teacher does not know the contents, or very little, of the vocational subjects. Also, the vocational teacher does not know how to help the learner link the mathematical content to the vocational content where it needs to be applied.

Process in the project

Two years ago we did a pilot study to see if integrating mathematical content with the vocational subject would make any difference to the students. We chose the gearbox as a common topic the vocational teachers thought students had problems with.

The following model was used in a textbook:

Gear ratio; $u = \dfrac{z_2 \cdot z_4}{z_1 \cdot z_3}$

where z_1 stands for the number of teeth on the gearwheel on shaft A in the gearbox and z_4 for the number of teeth on the gearwheel on shaft B (figure beneath). z_2 and z_3 stand for the number of teeth on the gearwheels on the common shaft.

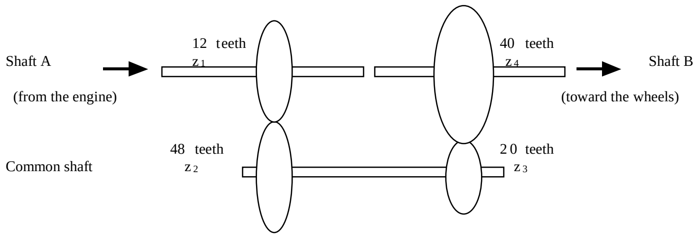


Figure 1

The gearbox works like this: The wheel with 12 teeth (shaft A) drives the wheel with 48 teeth. And the 25-teeth wheel sits on the same shaft as the wheel with 20 teeth, which in turn drives the wheel with 40 teeth. This means that the number of revolutions from shaft B is less than the number of revolutions of shaft A.

From this formula we get a new formula, $u = \dfrac{n_1}{n_2}$

where n_1 and n_2 stand for the number of revolutions from shaft A and shaft B respectively.

Making calculations using the formula above causes difficulties for most of our students. The students have difficulty understanding the formulae and calculations. Our task is to help students meet the mathematical prerequisite requirements of course A, but it is also to make them understand, at the same time, the function of the gearbox. The teacher should co-ordinate instruction in these topics with instruction in topics such as multiplication and division of rational numbers in connection with percentages and scale. One important principle in our work is, to try to eliminate any irrelevant mathematics from situations such as the gearbox model above.

We can look at the problem in two ways: either in terms of the number the teeth of the cogwheels that show changes in revolutions, or in terms of the gear ratios. These are in fact inverses of each other. See Figure 2 below.

The pinion with the 12 cogs is engaged to the pinion with the 48 cogs. As the 12-cog wheel rotates one revolution the big pinion rotates ¼ revolution. The process is repeated once more. The number of revolutions from the engine shaft is

The KAM project

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reduced in the gearbox and the increase in momentum (gear ratio) is thus inverse to the increase.

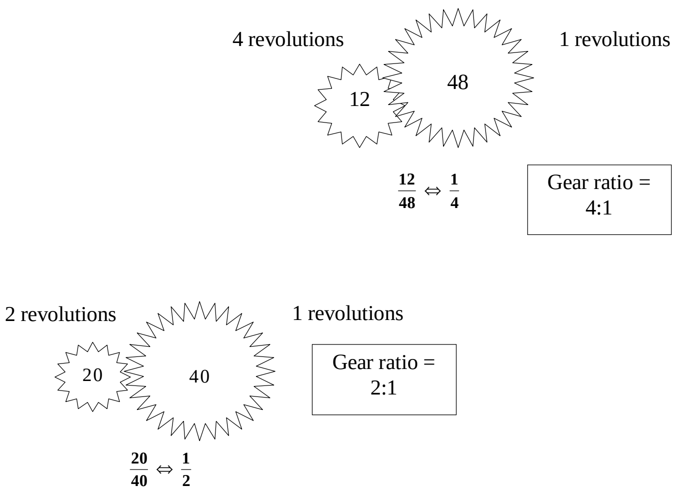


Figure 2.

The large 48-tooth wheel is on the same shaft as the 20-tooth wheel, hence we can combine the ratios to find the overall effect.

Gear ratio = 4:1 & Gear ratio = 2:1

⇓

Gear ratio = 8:1

Four times and two times bigger
=
eight times bigger

Figure 3.

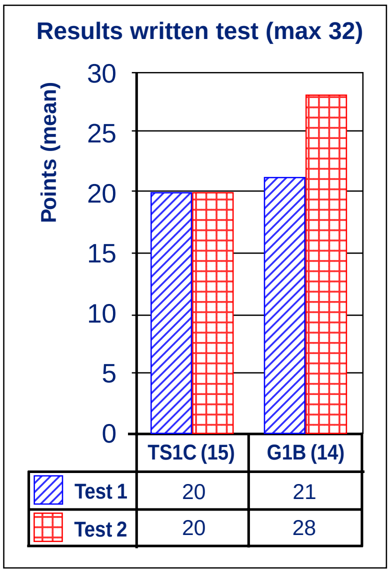
To understand the gearbox we think it is easier first to look at the number of teeth (the circumference) to understand what happens in the gearbox and then via exercises show that the ratio between revolutions (teeth) and the gear ratio (momentum) are inverses of each other.

For the vocational students we need to connect the function of the gearbox with momentum and we do this with the help of a balance. As an application of this, you use a lever and the action of a torque wrench on the bolt to demonstrate this.

To explain the role of the transmission of power and the relation of the power to the number of revolutions, you can use a 10-speed bicycle that has been disassembled. From this demonstration equipment, there are many activities that give the students concrete experiences with power, revolutions, and moment. The students then proceed through another demonstration where they work with starter motors, and finally to an actual gearbox demonstration.

In the pilot project the experimental group was a class of 14 students. The control group was a class that had the same result as the experimental group in the mathematical pretest (ratio and percentages).

The two classes chosen were both taught mathematics in the Vehicle course where the understanding of the gearbox is a part. A teacher who had not actively taken part in the development of the model and the material taught the control group in mathematics. The difference in the teaching was that the experimental group had more time studying the gearbox in their vocational classes and had also specially designed teaching material for fractions, ratios and percentages. At this stage we were interested in looking at whether the students´ knowledge and thinking about these sections of mathematics had changed, i.e. if we had any success in our teaching strategy.



The results from the written test in Mathematics (max 32 points) is shown in the graph. The number of students in each class is written in brackets. Test 1 was a pre test in Mathematics before teaching ratio. Test 2 was given to the students after ratios had been taught. TS1C is the control group and G1A is the project group.

We were also interested to see whether the quality of the thinking had been effected as a result of the special teaching. For this reason eight students were interviewed after both the initial and the final tests.

Most of the students in these programs have not previously been successful in understanding mathematics. Part of the reason for this can be that the content has not seemed to be relevant to them. The thinking procedures they have constructed do not enable them to apply their mathematics. In order for the students to change their thinking modes, prerequisites are that they recognise this problem. They need to be exposed to an intellectual challenge. This will not happen if the teaching methods and content are no different from their previous experiences.

Through practical activity related to their future vocation the experimental group has been forced to question what they are doing, giving them reasons to change their former thinking modes. These new thinking modes are strengthened and deepened through the program in the mathematics class. The control group had traditional upper secondary teaching, where it was assumed that the students already had the basic prerequisites in mathematics.

The test results from the experimental group showed a significant improvement in mathematics and according to their vocational teachers in the vocational subject as well. The control group showed no improvement in mathematics at all.

An important part of this project is to give the students a positive attitude towards mathematics. Data about experiences of mathematics and attitudes towards mathematics were collected through open questions in semi-structured interviews close to each test. In the full Swedish version (Skolverket, 99) of this report all the answers to the questions given in the math test are analysed, but as this is a condensed version this aspect is not reported on here. However, it was clear that many of the students in the test group have changed their thinking modes. The experimental group students' self-confidence was strengthened and they became more motivated in their study of mathematics because of the relevance of the subject.

The results from the pilot study convinced us that we are on the right track, so during this past year we have also looked into the vocational content of the first year of education for truck drivers and mechanics. The material will be tested when students start their education after the summer.

The project bridges between theory and practice. Many parties are involved and interested, and it is very important to inform and to discuss our work and our findings with others, so please do not hesitate to make contact.

Involved in the management group of the project are:

Leif Maerker Bräcke Upper Seconday School, Goteborg Sweden.
ubylmr@brackegym.educ.goteborg.se

Lisbeth Lindberg, University of Goteborg, Sweden
Lisbeth.Lindberg@ped.gu.se

Barbro Grevholm, University of Kristianstad, Sweden
barbro.grevholm@mna.hkr.se

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Obituary - **Jose Damasceno**

by Ana Lucia Braz Dias, Universite of Brasilia,

Dr. Damasceno was looking forward to joining the Adults Learning Maths group in Boston for ALM7. He was going to present a report of research done on the matter that most intrigued him: chance and how people understand it. His flight ticket was bought, his registration was made. But something got in the way: an insistent pain on his hip was diagnosed as being due to a tumor. He was not going to be able to make it to ALM7. But life continues, we thought, as Mary Jane said, "we'll see him in Denmark next year".

Damasceno was told that the chances were high that he would have to have his leg amputated at the surgery. He was asked to choose whether he wanted to have the surgery or not. He took the chances, he betted on life. But after the 12-hour-long surgery, Damasceno passed away on August 24, 2000. Family, friends, students and the faculty could not believe that the ever-smiling young professor was gone.

Damasceno had been teaching at the University of Brasilia since 1997, after having done his doctoral work at Université Laval, in Canada, on the use of simulation in probability teaching. He was a source of inspiration to many, including myself, because his attitude was of permanent questioning and curiosity for the "whys" of our human condition, coupled with a joy for living. Damasceno did research because he really wanted to find out "why", not because he had to publish or show he was productive.

He was engaged in political groups for the rights of teachers and minorities, himself leading a very simple life in material terms.

We will not see him in Denmark, but since the Boston ALM meeting was his last professional goal and source of excitement, a little about his story may help fill some of the gap left. And since the organizers of ALM7 and all those who attended the presentation of his paper by me knew him from afar and followed in some way his final drama, it seems appropriate to let ALM members know that this fine mathematics educator, researcher and friend is not among us anymore.

Perhaps he finally knows now the true role of chance and destiny on our lives.

Publications

Damasceno, J. A. (1996). Conceptions manifestés par les élèves durant la modèlisation-simulation d'une situation aléatorie a l'aide de l'ordinateur. Doctoral dissertation. Université Laval, Quebec. Supervisor: Dr. Claude GAULIN.

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Research & reports

Adults' Mathematical Thinking and Emotions

A Study of Numerate Practices

by Jeff Evans.
London: Routledge/Falmer, 2000. 294 pp. ISBN 0-750-70913-8 (hbk)/ 0-750-70912-X (pbk)

I welcome this book written for anybody interested in adult's relationship to mathematics! As one of the very few veterans in the young research area, 'adults and mathematics', the author Jeff Evans is the right man for the job. I have also read the book as a document illustrating the theoretical and methodological development in our area from the 1980s up to 2000.

Theoretically, Evans construes his own original position drawing on works such as those of Jean Lave and Valerie Walkerdine, and ideas from poststructuralism and psychonalysis. Furthermore, he illustrates a number of ways of fruitfully combining quantitative and qualitative methodologies in educational research. In the book, we find the following issues investigated:

- the ways in which numerate thinking and performance of adults are context-related
- the inseparability of thinking and emotion, and the consequent ways in which mathematical activity is emotional, and not simply cognitive
- the understanding of mathematics anxiety in psychological, psychoanalytic and feminist theories
- social differences in mathematics performance, anxiety and confidence.

It concludes with valuable reflections for changing practice, including making contexts for learning more student friendly, and extending the scope of numeracy to be empowering in learners' lives.

The book has 11 chapters structured in two complementary parts. In the first part, Evans describes the conceptual basis, methodology and findings of the quantitative part of his study. In the analyses, it is assumed that context is specified appropriately by the wording and format of the particular task for performance, or self-report item for anxiety. In the second part, Evans develops the conceptual basis and methodology, and he presents the findings of the qualitative part of his study. In these analyses, he proposes a notion of context of activity (e.g. mathematical thinking) understood as *positioning in discursive practices*.

What is an adult? This is a question that deserves a debate within ALM. In the study, Evans understands *adults* as people of a range of ages, who:

- participate in a substantial range of activities and social relations, normally including some outside the home, school or college
- have at least the opportunity for paid or voluntary work
- are conscious of having social or political interests. (p.5)

What is adult numeracy? This is a question actually debated within ALM. Evans presents the distinction between numerical skills proficiency and functional numeracy which provides the basis for differentiating two types of performance items in his survey of adult numeracy - *school mathematics* and *practical mathematics*.

In this connection, transfer is a central issue. Evans' critical discussion of transfer, as the (attempted) application of school mathematics learning to non-school contexts, aims to clarify the problems with several current approaches to it, and to show how his approach helps to re-conceptualise and resolve the problem, at a theoretical level. In particular, he criticises 'utilitarians' for their overly simple faith in transfer as relatively unproblematical. On the basis of his findings, he argues that task, and thinking done on it, always need to be understood as dependent on the context, including the social relations of its presentation, for its meaning. Evans is calling his 'sceptical-optimist' approach to transfer *'translation'*. A movement which involves transformation, since the sign, the relation between word and meaning, also depends on the rest of the discourse:

> *Calling the process translation/transformation reminds us that the translation can be 'free', as well as 'strict', and the mathematical tools (such as procedures for calculating) may themselves be changed in the process.* (p.233)

In Evans' understanding of adults, their participation in activities and social relations outside school is essential. But among his interview problems, there is only one authentic article (a payslip), the others are constructed, and there is only written material, not any concrete material. I think this is a methodological weakness in his study.

In his lecture at ICME9 in Japan 2000, Shlomo Vinner stated the following:

> *My claim is that human behaviour has so many aspects which are not cognitive that focusing mainly on the cognitive aspect can be misleading.*

With his interdisciplinary study, Jeff Evans has given us multiple perspectives on the very complex issue concerning adults' mathematics thinking and emotions.

Reviewed by Tine Wedege, Roskilde University, Denmark
E-mail: tiw@ruc.dk

Book Reviews

8th International Conference on Adults Learning Mathematics

ALM-8

28-29-30 June 2001

More than 30 quality proposals received

Obviously, the conference theme "Numeracy for Empowerment and Democracy?" has inspired many researchers and practitioners. We have received more than 30 quality proposals for workshops, paper presentations, topic groups, and poster presentations. The program and the abstracts will be available on the ALM website from 15 May. (www.alm-online.org). A preliminary program is already available.

We encourage you to book for the conference in good time before the closing date of 1 June. Delegates will receive information about the program, conference venue, accommodation etc. early in June.

We look forward to seeing you in Denmark in June.
The local organising team -
Tine Wedege, Roskilde University
Lene Riberholdt (conference secretary) lene@ruc.dk
Lena Lindenskov, Danish University of Education
Lene Oe. Johansen, Aalborg University
Eigil P. Hansen, Adult Educational Centre.

More information about the conference

More information is available at the ALM web-site:
http://www.alm-online.org

ALM - Annual General Meeting

Registered Charity 1079462
Company No. 3901346

The Annual General Meeting of ALM (Adults Learning Mathematics - a Research Forum) will take place during the annual conference.
Date: Thursday 28 June 2001
Time: 7.00 - 9.00 pm
Place: Roskilde University, Denmark
This meeting will consider the reports of the Trustees and the accounts of ALM and will elect the Trustees for the following year. It will also be an opportunity to discuss the future developments of ALM.

David Kaye
(Company Secretary)
c/o City of Westminster College (DLD)
25 Paddington Green, London W2 1NB, UK

Practitioners in ALM - Add your voice

Invitation for a Discussion at ALM-8

ALM was founded on the basis that it combined and integrated the work of practitioners and researchers in the field of adult mathematics education. In Newsletter 12 (February 2001) John O'Donoghue, the Chair of ALM, said that *ALM is a community of practice where the practice is research* and stated that this issue needed to be pursued. At the ALM-8 Conference there will be an opportunity for members to discuss this issue in order to collect ideas and proposals on how to activate and realise this research in practice within our community.

Many individuals associated with ALM have found ways of becoming a "teacher-researcher"; or perhaps they have found a comfortable home in ALM after becoming a "teacher-researcher". In Newsletter 11 (November 2000) there are articles, by Pam Meader and Gelsa Knijnik, which give useful individual perspectives on this matter.

An immediate concern though is that although ALM serves as a vital link with the research community for many practitioners, that link is tenuous as the activities of ALM are, at present, limited. A member receives the regular newsletter and has the opportunity to attend our major annual conference. However, it is often difficult for practitioners to attend such international conferences. There is a danger we will not attract and possibly lose practitioner members unless we create and encourage more active links within the organisation.

We encourage practitioners and researchers at ALM-8 to discuss this issue in the session 'Practitioners in ALM', led by David Kaye and Eigil Peter Hansen. In this workshop we will explore how possible research questions arise out of our everyday practice and can be taken further. Members who are not able to attend the conference are encouraged to send their ideas and proposals to myself or the ALM-trustees (see the back page), and these can be discussed at the conference. A few suggestions for discussion include:

- Develop local meetings and groups
- Encourage local practitioner participation at annual ALM meetings
- Investigate partnerships between practitioners and researchers.

Also, ALM has been a registered charity for less than a year and we are still exploring how we can use our new status to support and encourage new research that arises directly from practice and includes practitioners in the research process.

David Kaye
City of Westminster College, London, UK
email: david.kaye@cwc.ac.uk

About ALM

Company No. 3901346
Charity No. 1079462

Adults Learning Maths – A Research Forum (ALM) is an international research forum bringing together researchers and practitioners in adult mathematics/numeracy teaching and learning in order to promote the learning of mathematics by adults.

What is ALM?

ALM was formally established at the Inaugural Conference, ALM-1, in July 1994 as an international research forum with the aim to promote the learning of mathematics by adults through an international forum which brings together those engaged and interested in research and developments in the field of adult mathematics/numeracy teaching and learning.

ALM is a forum for experienced and first-time researchers to come together and share their ideas and their reflections on the process as well as the outcomes of research into hitherto neglected area of adults learning mathematics. ALM puts people in touch with each other, providing a framework for collaboration and helping to stimulate and develop research plans. We are especially keen to encourage practitioners to undertake research.

Since 1994, ALM has gone from strength to strength and now has 140 members in 19 countries. In 2000, it was registered as a company and as a charity in England and Wales.

What does ALM offer?

ALM membership brings with it opportunities to:

- contribute to an international forum of researchers and practitioners in the field
- share concerns, insights and research at ALM annual conferences, and to attend at a reduced rate
- receive ALM newsletter (free)
- receive ALM conference proceedings (free of charge to conference delegates). These proceedings constitute the most significant and authoritative collection of papers on adults learning mathematics available today
- network, electronically and otherwise, with practitioners and researchers in the emerging field of adults learning mathematics.

ALM Officers

Join ALM today!

ALM is actively seeking to expand its membership worldwide. Membership is open to all individuals and institutions who subscribe to its aims. For details contact Sue Elliott, Membership Secretary at the Centre for Mathematics Education, Sheffield Hallam University, 25 Broomsgrove Road, Sheffield S10 2NA, UK email: S.Elliott@shu.ac.uk or your regional ALM membership agent:

ARGENTINA Dr Juan Carlos Llorente, Fundacion PAIDEIA, Instituto de Investigacion Educativa, Mitre 862 (8332), Gral Roca, RN, Argentina. Email: JCLlorente@paideia.edu.ar

AUSTRALIA Dr Janet Taylor, OPACS, Uni. of Southern Queensland, Toowoomba, Australia. Email: taylorja@usq.edu.au

BRAZIL Eliana Maria Guedes, Dept. of Architecture, Mathematics and Computing, UNITAU, University of Taubaté, Sao Paulo, Brazil. Email: emg@aquarius.com.br

DENMARK Dr. Tine Wedege, IMFUFA, Roskilde University, Box 260, 4000 Roskilde, Denmark. Email: tiw@ruc.dk

NEW ZEALAND Barbara Miller-Reilly, Student Learning Centre, The University of Auckland, Private Bag 92019, Auckland, N.Z. Email: Barbara@math.Auckland.ac.nz

REPUBLIC OF IRELAND Prof. John O'Donoghue, Dept of Maths and Statistics, University of Limerick, Limerick, Ireland. Email: John.ODonoghue@ul.ie

THE NETHERLANDS Mieke van Groenestijn, Utrecht University of Professional Education, PO Box 14007, 3508 SB, Utrecht, The Netherlands. Email: Mieke.v.Groenestijn@feo.hvu.nl

UNITED KINGDOM Sue Elliott, Centre for Mathematics Education, Sheffield Hallam University, 25 Broomsgrove Road, Sheffield S10 2NA, UK. Email: S.Elliott@shu.ac.uk

USA Dr Katherine Safford, Saint Peter's College, Kennedy Boulevard, Jersey City, NJ 07306, USA. Email: SAFFORD_K@spvxa.spc.edu

Membership fees

Individual:	£15	Institution:	£30
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Editorial Committee

For more information email: newsletter@alm-online.org