

The Slowly Changing Face of Adults Mathematics Education in Austria

Not Learning from the Past Means no Chance of Planning Improvements for the Future

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The theme of the conference presents an opportunity for looking back to get better data for the analysis of the actual situation. Many years ago at the beginning of the nineties a group of researchers in Linz carried out some projects to analyse the situation of adult mathematics education in Austria. Now I am taking part in the EMMA project. This gives an opportunity to look again at the adult mathematics education in Austria. Comparing the results leads me to the ironical change of the conference theme that I use as the title for my presentation. In Austria there is a growing number of course offerings that are orientated towards the economy, but a shrinking number of courses to improve the level of understanding of society and its mathematical aspects (aiming at critical citizenship). The government reduced its activity in this field and there is no clear sign or development of increasing quality in teaching or learning qualities. But there is at least one positive example I would like to discuss. It is an institution that helps disabled persons to come back to work and life called BBRZ.

Key words: mathematics education; adults learning mathematics, situation in Austria, research results, data and comments

EMMA in Austria

Within the framework of an EU project entitled ‘European Network for Motivational Mathematics for Adults’ (EMMA) I have conducted research since December 2005 in order to analyse the actual situation of the further mathematical education of adults in Austria and identify examples of ‘Best Practice’. For more detailed information on EMMA readers can consult, <http://www.statvoks.no/emma/index.htm>.

1. Introductory key words concerning the situation as a whole

Since the research conducted in Linz on further mathematical training at the beginning of the 90's (compare summarised [1]) the situation has not changed much. Adults learn mathematics almost exclusively again or for the first time because they have to do so for professional reasons. At some Volkshochschule (VHS) there is sometimes available a basic mathematics course, mainly for immigrants. In VHS some courses are also offered to help people to obtain their school leaving certificate i.e. secondary school exams to qualify for an apprenticeship or courses to entitle the person in question to attend a University. Some courses are also offered for immigrants (e.g. basic literacy, numeracy and cultural knowledge, partly integrated). The largest share of further training is performed in the institutes of further training of the social partners (BFI stands for the Berufsförderungsinstitut and WIFI is the Wirtschaftsförderungsinstitut). Here of course there is a predominant market situation and since mathematics is not really a positive advertising word, there are almost no mathematics courses visible at first glance in the course programme. A closer examination reveals courses including mathematics as a part of content that is offered e.g. geometry for carpenters or business economic calculations for business men. Two students, Barbara Lackner and Simon Wieser, conducted intensive research to record and analyse the courses on offer in winter 2006/2007 in Upper-Austria and Vienna. I will present some of the results of their research in the following section.

First of all some more key words on the actual situation in general are offered: the teachers performing further mathematical training or training with a mathematical content are doing this almost exclusively as a secondary profession. In their main profession they teach at schools, or they are specialists from the respective professions (e.g. engineers who teach in courses for skilled workers) or they are also university students who finance their studies in this way. Some of these students have neglected their studies over the years as a result of this secondary activity to the extent that they are now de facto seen by the authorities (social security) as teachers working for a fee doing this as their main occupation. No specific qualifications in mathematics education are formally needed for teaching mathematics to adults as in school system. There is no specialist didactic qualification for teaching needed as basic qualification. In the same way there is no specific specialist didactic further training related to mathematics education for the teachers in adult training. Even if there is a certain psychological need (subjective needs) in addition to the objective needs, because the teachers do not know how they should behave as a teacher in their course, their time and commitment in their secondary activity is not sufficient reason for them to do further training for this themselves. The few offerings in terms of further training for teachers from the training institutes, which were reported to me, are of a general nature (presentation techniques etc.) and are rarely made use of voluntarily.

The field of general mathematical training specifically concentrated on numeracy, which is actually at the centre of my analysis of the actual situation due to the focus of the EMMA project, is only marginally represented in the Austrian further training landscape. One reason for this is the official state policy. From an official point of view, there is no problem in this field; Austria has not yet participated in an international comparative study on the mathematical knowledge of adults. And as long

as it is not confirmed in the form of a PISA study for adults (which will possibly take place at the end of the decade – an OECD Study named PIAAC) there is no reason to establish a state further training institute or to finance on a large scale (such as with the corresponding BBC campaigns in England) mathematics basic courses in another way. Unless possible negative consequences for the economic state of Austria are identified namely, that in Austria as in other Western industrial countries a relevant share of adults are illiterate in mathematics (mathematic knowledge at elementary school level or less) action in this regard is unlikely.

Thanks to friendly cooperation with the Upper-Austrian Arbeitsmarktservice (AMS, earlier: Labour Exchange), I was able to evaluate data on mathematical knowledge from tests with unemployed persons with the help of a student, Ms Karin Schwarzbauer. Since this data is of course not representative I would like to mention at this junction only that as was to be expected people who have been looking for employment for a longer period of time likewise revealed deficits in the field of mathematics. These people are required to undergo extensive tests at the AMS to forecast their need for training and to be in a better position to plan this training. In a second non-representative study another student, Florian Raber, set adults some tasks from the PISA Test and found on average that they solved slightly more tasks than the pupils. All the same a large share of the adults in question were not prepared to do the test and respectfully handed it back unsolved after only forming a slight impression of difficulty (“Oh no, I can’t do that!”). It will be possible to find all of the data mentioned here including the evaluations at the internet address mentioned earlier: <http://www.statvoks.no/emma/index.htm> when the EMMA project comes to an end at the end of the year.

2. Some data on the offerings for further training courses involving mathematics in Upper-Austria and Vienna in winter 2006/2007

Austria has nine different regions. I selected two of them, Upper-Austria and Vienna for this analysis because Upper-Austria is a “high tech” region and Vienna is the capital with the highest number of people from other countries living there. The purpose behind this data collection and analysis was to find out what is *actually* going on in mathematics education and mathematics containing education. The budget for the research was very small. Two students, Barbara Lackner and Simon Wieser, conducted intensive research to record and analyse the courses on offer in winter 2006/2007. They used the internet to get the information and made some personal visits to course offering institutions in Upper-Austria. They worked hard and collected a lot of data. The analysis of this data is reduced here to put a spotlight on some of the results. Many questions arising during the process of analysing data could be a starting point for new research. I hope that there will be a chance to do some of this research in future.

In Upper-Austria a total of approx. 23 000 further training courses were offered in Upper-Austria during the year 2006/07 lasting several days. The most important suppliers were the AMS (approx. 3000, AMS is the official labour market service, see: www.ams.at), the BFI (approx. 7000, BFI is the vocational education institution of the labour organisation, see: www.bfi.at), the VHS (approx 6100, VHS are adult education institutions supported by cities, communities and the chamber of labour, see for example www.vhs-wien.at) and WIFI (approx 6500, WIFI is the vocational education institution of the chamber of commerce and industry, see: www.wifi.at). Of these

courses more than 4000 contained mathematics, in the AMS approx. 600, in the BFI approx. 1500, in the VHS approx. 100 and in WIFI approx. 1900. 4000 of the 23000 is about 17.4 % - not so much but more than expected because mathematics is not a word used in advertising course names and course descriptions.

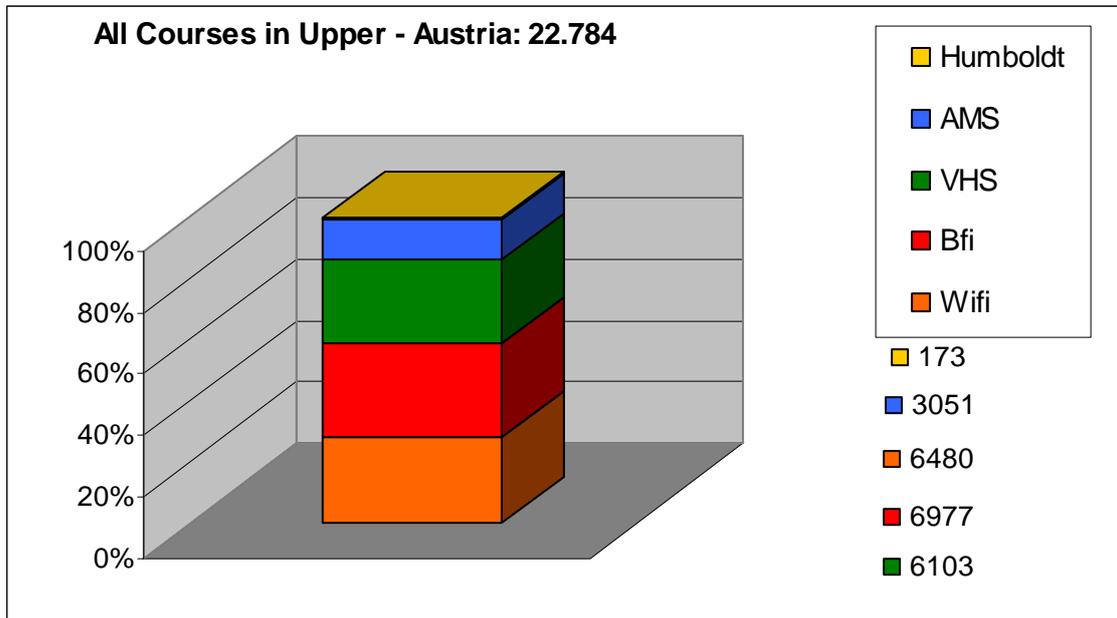


Figure 1. All courses offered in Upper-Austria in Winter 2006/2007

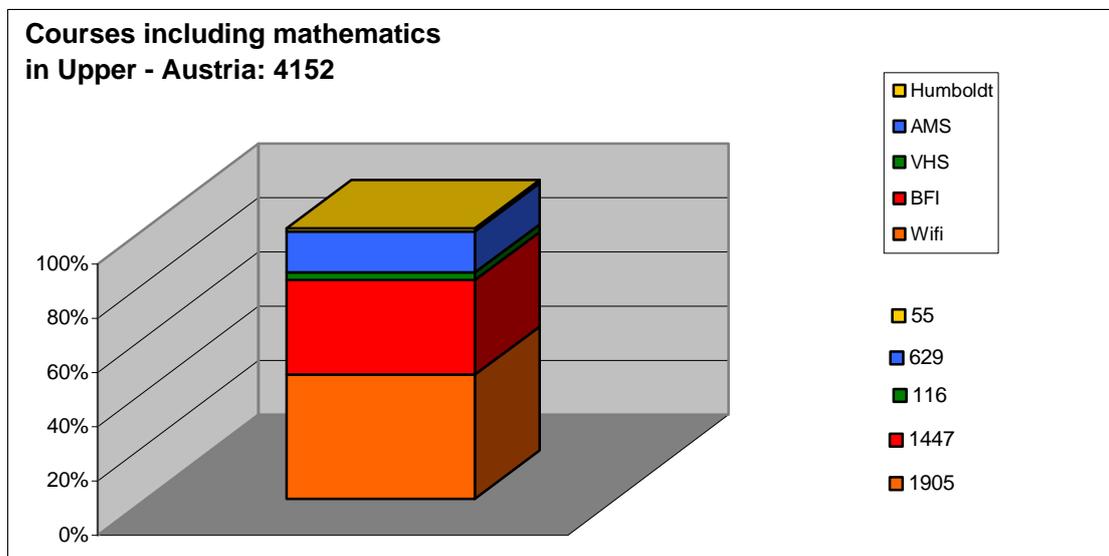


Figure 2. All courses including mathematics offered in Upper-Austria in Winter 2006/2007

The corresponding data from Vienna reveals a slightly different relationship between the overall number and the courses with a mathematical content: AMS (approx. 11000/260), BFI (approx. 2400/500), VHS (approx. 11000/630) and WIFI (approx. 4500/1100). The situation of BFI and WIFI, the vocational orientated social partner institutions, seems to be similar in Upper-Austria and Vienna, but the other institutions offer much more courses without mathematics. To explain this, it should be

remembered that in further vocational training mathematics content frequently plays an important role or at least a secondary role whilst the VHS traditionally places the focus of its courses on languages or health matters.

A closer look at the mathematical content listed shows that 75 to 80 percent belongs to material in the upper level of school (sec. II). The remainder, apart from a few exceptions, is material of sec. I. Elementary school material features in 24 courses in Upper Austria and in 9 courses in Vienna.

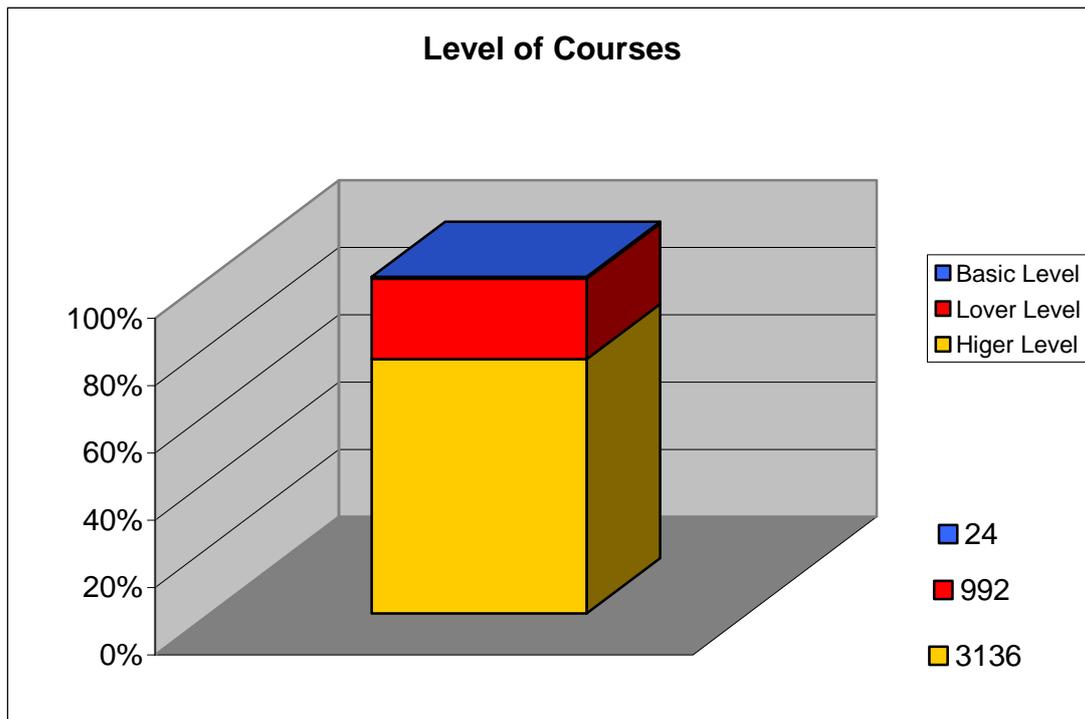


Figure 3. Level of courses offered in Upper-Austria in Winter 2006/2007

Some reasons for the perhaps unexpectedly high level of mathematics content can be found in a few examples from the course content:

Austrian standards, building physics, loading assumptions on the roof, process measures, basics static principles, construction, the calculation of joints, the construction of arches: cylindrical arch constructions and spherical arch constructions for structural engineering, variance analysis: single factorial and multiple-factorial variance analysis, extensions with co variants. Regression analysis: simple and multiple linear regression analysis, non-linear regression – curve adjustment, introduction to logistical regression. Factor analysis: data reduction with and the significance of factor analyses, the interpretation of results. Chard-analyses: the preparation of a tree model for group segmentation, the differentiation between groups, the interpretation and analysis of tree models, decision trees with different goal criteria. Cluster and discrimination analysis: types of cluster analyses, the hierarchic cluster processes, cluster centre analysis, the determination of relevant clusters, the interpretation of cluster results. The development and interpretation of discrimination functions, the evaluation of the separation force of discrimination characteristics, discrimination analyses as forecast models, quality measures, across-the-board possibilities for

applications in the SPSS – course, CAD or the calculation of circuits (couplings) are other possibilities.

What mathematical content is predominant? Following a classification into technical, commercial and general mathematical content it can be seen that these comprise a third each of the courses on offer in Upper-Austria and Vienna.

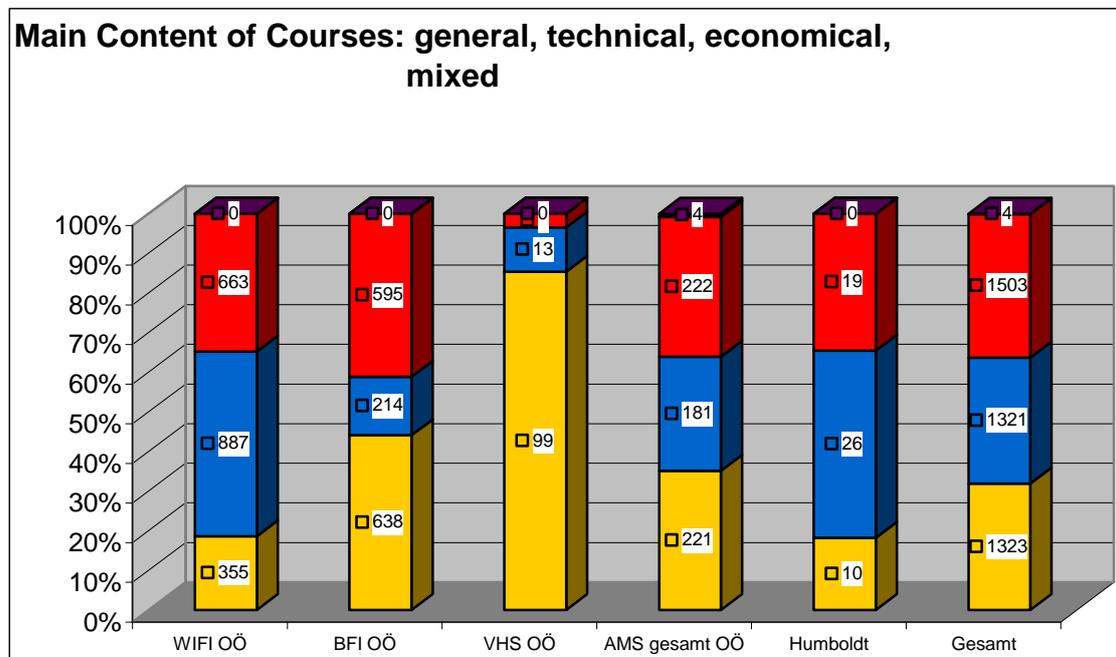


Figure 4. Main content of courses offered in Upper-Austria in Winter 2006/2007

Information about teachers and their qualification is sometimes part of the course information because the institutions generally make this information available on the internet. Maybe the thinking is that it is a good advertising strategy - for example a course for electricians is given by an engineer who has a university degree. A comparison of collected information with interview or discussions with course organizers leads to the conclusion that the main criterion for the selection of teachers is a personal selection done by the responsible managers. All the institutions have organized feedback from participants about their courses and this sometimes leads to a teacher not being asked to hold the next course. Most of the teachers are part time teachers. Their main job is at school - teaching adults is something extra and is quite different. Only the BBRZ (see next paragraph) employs full-time teachers. The work with handicapped persons has special psychological needs that include the need for special teacher training.

Looking at the market for courses the impression is very strong that money or in other words economic reasons are the main motivation for attending courses. For the course offering institutions and the participants it is a market situation: some qualification seems to be needed and therefore the customers look to which institution offers such a course or qualification. Very few courses are sponsored by the government. However, some offered by AMS are indirectly sponsored by the government. So the market analysis and the experience of the institutions comprise the basic knowledge inputs for

planning courses and curricula. More exactly, when an institution wants to offer a new course about subject X, this institution will hire a teacher and ask him or her to give the course. The teacher work includes didactical planning in detail, use of learning materials etc. Sometime there are some guidelines for these subjects like technical or economical rules or laws about this subject that have to be including or explained.

3. Best Practice: the BBRZ in Linz

Some 40 years ago the “Berufliches Bildungs- und Rehabilitationszentrum” (see: www.bbrz.at) was established in Linz [2]. This is a service company in/for professional rehabilitation, which means that it helps people who for health reasons (accidents etc.) are forced to learn another profession so as to be able to re-enter the labour market. What makes it special and exemplary are the individual advice which it provides and its training procedures. According to their procedures a decision is made every week on the basis of the progress achieved in the module just completed, whether the course programme continues, whether a module is to be repeated or another necessary basic unit should be added. If for example problems are encountered when calculating interest which can be explained by a lack of knowledge of calculating percentages, then a corresponding unit is added to the training programme of this person. In addition lessons are provided for individuals and advice is offered by the institution which leads to very high success rates in the course and to the high recognition of these courses by industry. The success rate for people who find a place of work after their training with the BBRZ is correspondingly and pleasingly high (70% to 80 %). As a part of the Austrian EMMA research Magistra Dipl. Ing. Karin Schatzl wrote a description using two typical examples of people who qualified at BBRZ and included a lot of background information. I would like to say “thanks“ to Magistra Dipl. Ing. Karin Schatzl, Direktor Dr. Karl Dolezal and the head of a BBRZ department in Linz, Magistra Alexandra Hiller (both BBRZ) for their help.

I think it is easier to understand what is going on if I try to explain the two examples, Mrs. Huber and Mr. Smith. They are fictitious, but typical persons. Imagine that Mrs. Huber was a very skilled hairdresser, but she got ill from sprays (allergy) and now she is unemployed, without a job for health reasons. The AMS will pay her some money for a while and after this she will get a little money from the government (social welfare). This is indeed not a good outlook for the rest of her life. But she has a chance to train to be qualified for another job. Another insurance (AUVA = Allgemeine Unfallversicherung – a general accident insurance in Austria) will pay for this course if a special evaluation of her needs leads to a good prognosis. What does this mean? Mrs. Huber is invited to visit the BBRZ in Linz for evaluation. For one week she is interviewed by doctors of medicine and psychology and tested by teachers of the BBRZ. The main questions are:

Medical: Is she healthy enough to learn and to do another job?

Psychological: Is she willing and able to learn and to work?

Qualification: What qualification does she have and what additional qualification she will need to do another job?

Labour market and BBRZ qualification offers: What type of job is possible and what would she like to learn?

Money: What is her financial situation and which institution will pay how much for the qualification course?

The result of the diagnostic week is positive for Mrs. Huber. The decision by the experts and Mrs. Huber is that she is able to and she will learn to work as an optician (making and selling glasses). A contract is made - Mrs. Huber is allowed and willing to go to BBRZ to study for her new qualification. She will live in a little apartment in a student's resident near the building where the courses take place because her home is not in Linz and gets some additional money to live there. Her contract involves a 36 hours a week study time. Her individual course programme is planned according to the results of the diagnostic week and especially the knowledge tests, where teachers watched her solving tasks and interviewed her. Her course programme consists of a basic part (12 weeks to renew special knowledge she needs for the main course) and the main course (13 months). I can't explain the course in detail here but I will try to give a brief outline. She studies biology (eyes) and physics (optics, colours), mathematics (geometry, calculation, economy for trade like bookkeeping and taxes), German for formal correct communication with customers and government etc., practical work including excursions and preparing for the final examine (external, at the Chamber of Industry and Commerce).

Two unexpected things happened during her course. Due to problems with percentages and equations Mrs Huber took extra courses to learn them. And Mrs Huber failed her examination in geometry. This has to be reported to the funding institutions but they decided to pay for an additional week, so she could finish the course and pass the final examine. Doing the practical part she worked at a company that employed her afterwards.

The second example shows a person with even more problems, Mr. Smith. He was a truck driver and worked as bus driver. He drove a bus with tourist bus through Europe for more then 15 years. So he knows a lot of cities all over Europe and the best routes to drive there. But in winter he had bad luck with snow and ice – he had an accident and he did not really recover. His spine was broken and he has to use a wheelchair. This is a medical, psychological and social disaster for him. But he has a chance, too. As the result of the diagnostic week in the BBRZ he has a new goal: Office assistant for tourism. This combines a job that he can do with his wheelchair where he can use his experience about Europe and travelling. The plan for Mr. Smith is in a way similar to the plan for Mrs. Huber. His training programme comprises a basic module with 12 weeks special and individual lectures and a 26 months main course. But he has psychological problems after some weeks. He fell into deep depression and has to go to hospital for some weeks. After a more intensive psychological therapy and diagnosis afterwards the insurance decided to pay for a new start and this time he was more successful. Though he was not a good learner and had to repeat several modules he finally passed the examination and got a new job.

In conclusion, there are two main reasons to help persons like Mrs. Huber and Mr. Smith in this way, both are important. One is economic: if they get a job because the insurance and the community pay for their qualification they will pay taxes and some money to the insurance for the rest of their lives. In many cases they more than repay

the training costs. The alternative would be to give them some money to survive for the rest of their lives without a chance to get anything back. The second motivation is social and psychological: people who have a job and who have mastered such a major crisis in their lives are much better off not only economically but also in psychological terms.

From a didactical point of view this BBRZ is a “best practice” example because they have an immensely complex functioning system for course management including a weekly feedback to each participant and in each module, a weekly decision about the plan for the next week (modules) for each participant and a weekly start for new clients with a very thorough evaluation/diagnosis at the beginning.

4. Some data about knowledge tests

Looking at further mathematical education from a market perspective or planning it from a national point of view is easier if there are valid data about the mathematical knowledge of adults. If we compare the situation of young students with the situation of adult learners we see a huge difference. Nations behave as if there is a market for company investment. Where do they build up new production sites? One more important aspect of this market simulation⁴ is the qualification of potential workers as employees of such companies. Tests like PISA give a simple (and not correct) ranking. So in many countries that are not at the top of this ranking the government tries to improve the position in the ranking list (this is not necessary the same as improving the quality of teaching and learning at school). But there is no ranking list for adults though the now living adults are the workers in now newly constructed factories. Perhaps a test like PISA for adults is the answer –such is mooted for the end of this decade?

The EMMA budget is far under the level that is needed to do a national representative knowledge test. But it was possible to switch a spotlight on two areas. One is a test that employed PISA tasks and was taken by about 140 adults on a voluntary basis. The other one is the statistical analysis of data from the labour market service (AMS) in Austria. A student, Florian Raber, worked for his diploma theses (Masters) to find adults who liked to be tested. Those adults he found who did not like mathematics or like to be tested performed well, better than the young Austrian students. A bigger test in Germany carried out by IPN came to similar results (LIT). Wolfgang Schloeglmann explains this in detail in the ALM 14 proceedings, too.

Mrs. Karin Schwarzbauer analysed the data from the AMS. If people do not find a job for a while they are invited to be tested by AMS to find out what they could learn to find a job. So the knowledge level of the tested adults is lower than average – but the average level is not known. You can find both reports on the EMMA server. Here are some observations.

⁴ I think that these decisions of companies have other reasons. Maybe they are much more irrational then estimated some time?

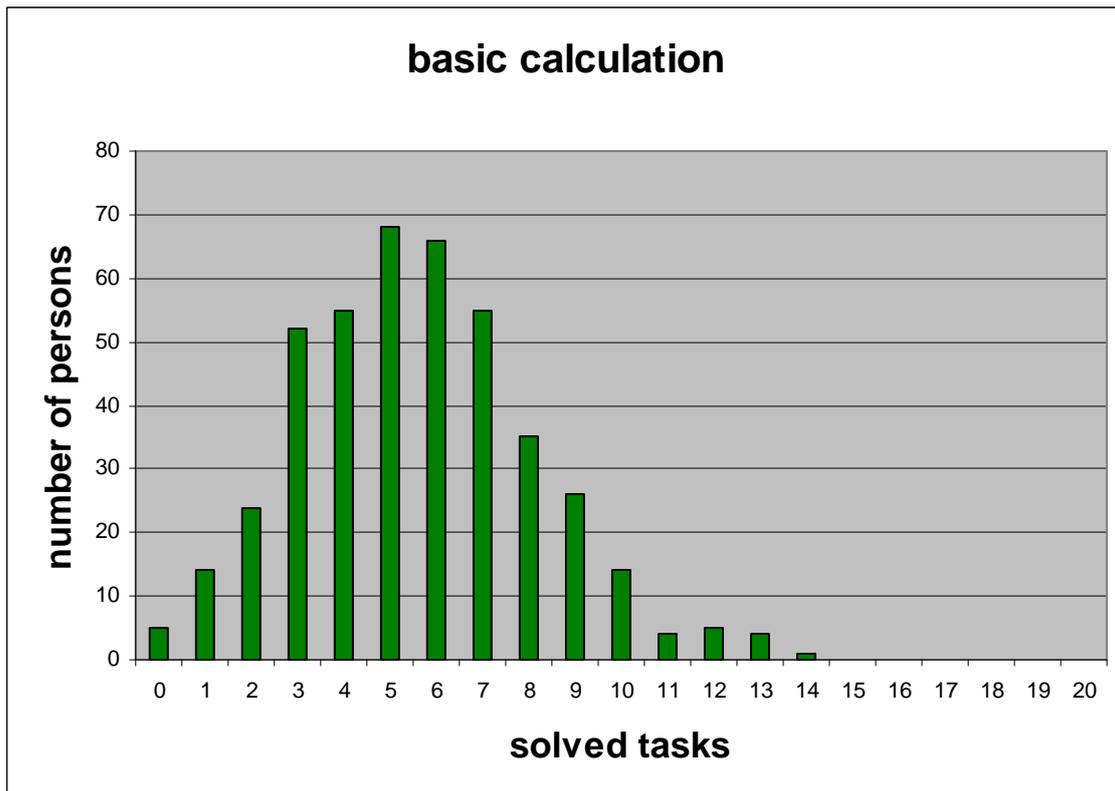


Figure 5. Solved tasks

Twenty tasks on basic calculations were given. The level of difficulty was low – such tasks are part of the curriculum for 6 to 10 year old girls and boys at school. If you think that the number of solved tasks is low please have a look at the next diagram. It shows what happened if simple text tasks are given.

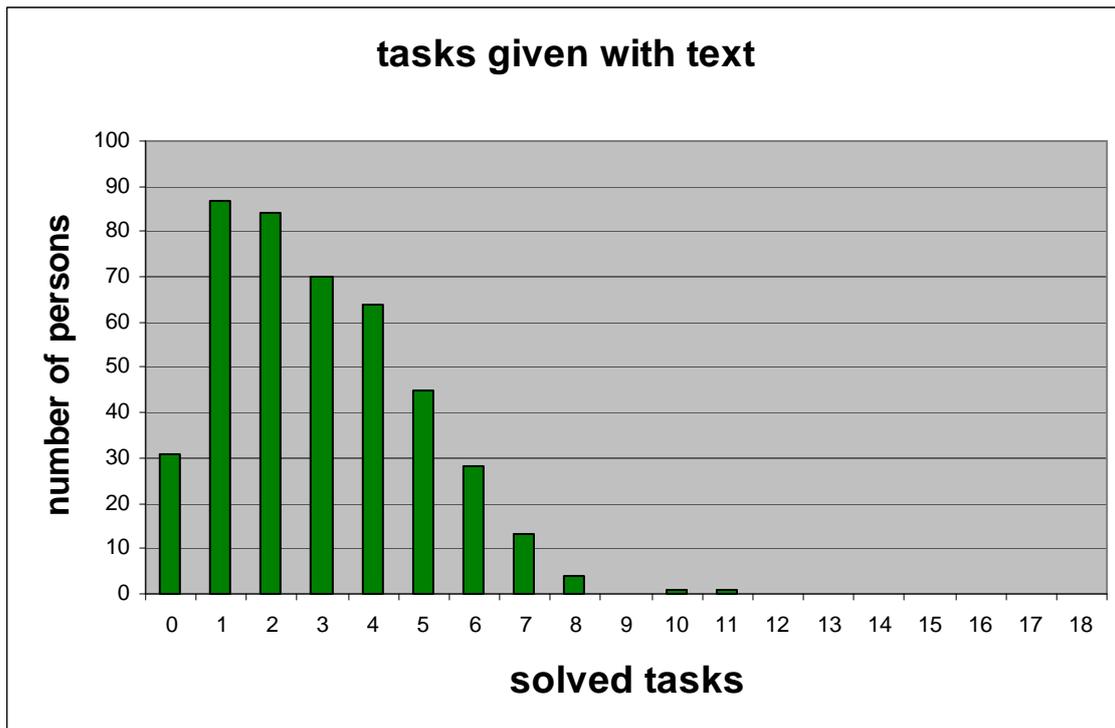


Figure 6. Solved text tasks

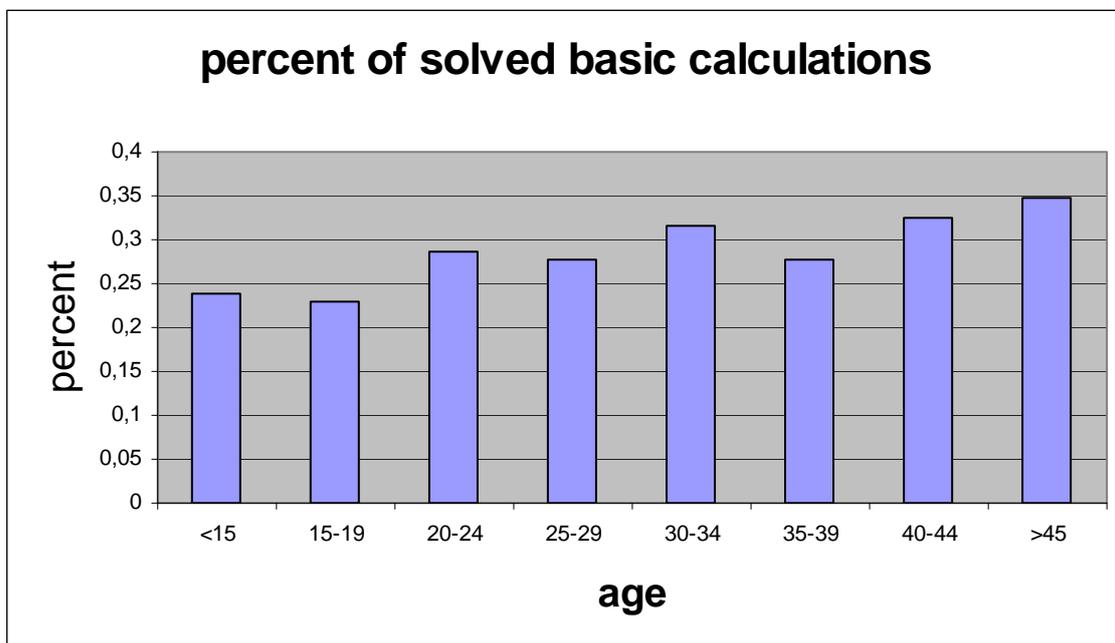
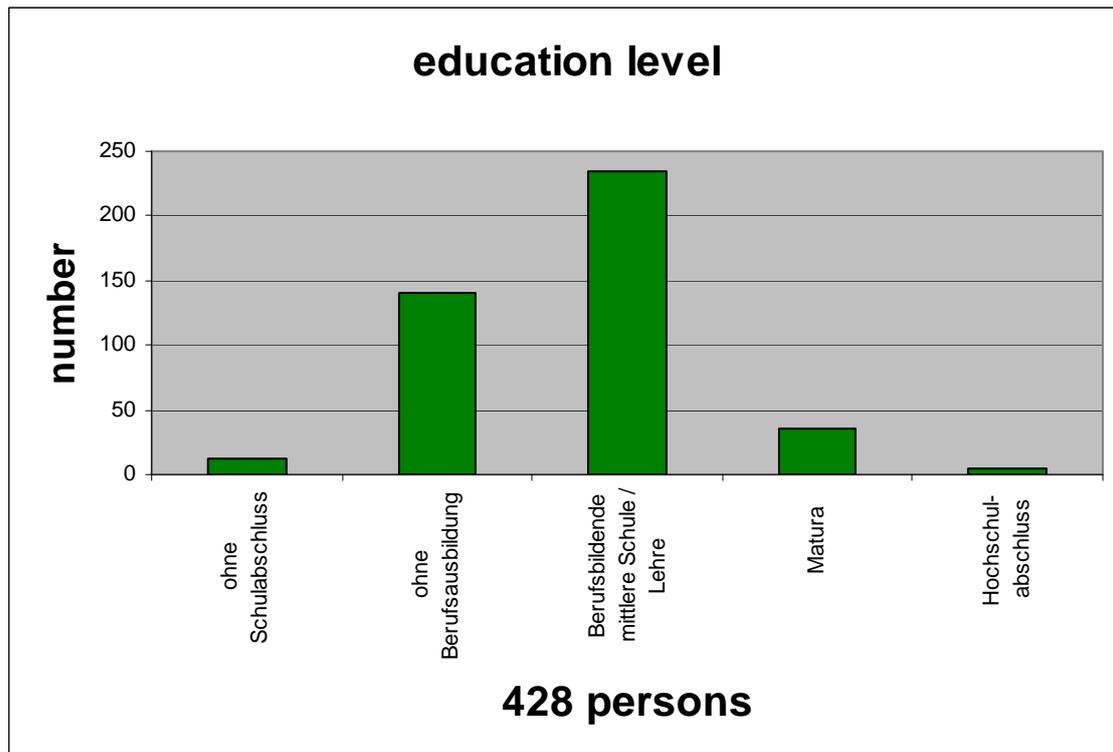


Figure 7. Solved tasks and age of tested persons

From my point of view it is surprising that there is no trend of sinking level according to growing age. If we compare what we remember from other subjects that we have learned in school – let us say Latin or Geography – we are sure that we loose our knowledge when we get older and do not use what we have learned. Translating Caesar, Cicero, Ovid or other Latin documents is very difficult or even impossible after

many years. If we travel to a foreign country we have to relearn the names of cities, rivers and mountains etc. Elders seem to be better in basic calculation than younger persons – why? I have two ideas. One is the change of teaching. Now a pocket calculator is typical tool for calculation. Many students use it in each situation, even if the task is something like $2 * 3 = ?$ Elder students (>45) used their mind to calculate. The second idea is well known, too. People that are about 30 years old often have children at school. They try to help their children and relearn what they learn in school.



The last observation is motivated by the low number of solved tasks. What is the education level of the tested persons? It is not as low as expected. Only very few did not finish school, most of them finished school and qualified for a job and some graduated at a level (ready to study). This shows again that the formal qualification level is not always a guarantee of a good level of knowledge.

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