Bundesministerium
für Bildung
und Forschung

# Online - Offline

## IT in Education

innovationen
wissensgesellschaft

August 2000

**Concept for action**
**Information technology in education**

The "IT in Education" action concept is a central element in implementation and strategic refinement of the action programme "Innovation and Jobs in the Information Society of the 21st Century". It is also the contribution of the Federal Ministry of Education and Research (BMBF) to implementation of the European Union's action plan within the framework of the eEurope Initiative.

**The Federal Government's Action Programme – Innovation and Jobs in the Information Society of the 21st Century**

Facilitate access to new media

Promote state modernisation

**Promote multimedia in education**

Create innovative jobs – promote new applications

Achieve a leading position in technology and infrastructure

Create trust and security by improving the legal framework

Intensify European and international co-operation

## 1. Information technology in education

Education shapes personality development and makes participation in public life possible. It is the basis for the viability of any modern, democratically constituted society.

Knowledge societies will face enormous educational challenges. As a result, they must increase their investments in education and revamp and restructure their educational systems.

**Germany's educational system must impart key competencies to both learners and teachers.**

**Germany's educational system must prevent the social exclusion that could result from new and growing qualification requirements.**

**Germany's educational system must support individual talent.**

**Germany's educational system must have assured quality and a service orientation.**

**Germany's educational system must be internationally oriented and must seek and promote exchanges with other countries.**

The Federal Government has initiated the reform processes needed to achieve these aims. In so doing, it is emphasising:

Individual, social and intercultural competencies such as creativity, responsibility and the ability to participate in public life.

Instrumental and methodological competencies needed to develop and apply knowledge, especially media and language skills.

A culture of lifelong learning.

Teacher training and further training that is adapted to schools' new tasks, in order to permit differentiated education.

Standards, in educational programmes and for educational providers, that are transparent for all customers and that safeguard the quality of programmes.

Giving educational institutions greater responsibility for their own budgets, personnel selection, modern management concepts and regular evaluation of programmes and services.

Enhancing the international orientation of higher education institutions, with respect to personnel, structures and programmes, and including development of marketing efforts for higher education.

Developing higher education institutions into internationally competitive providers of further training.

Education is the basis for economic and industrial innovation and competitiveness. And modern IT and communications technologies play a central role in this basis. To survive the transition to the knowledge society, economies must promote development and use of powerful IT and communications technologies and invest in knowledge for all individuals.

**Germany's educational system must**

- **make efficient use of new IT and communications technologies a basic part of teaching and learning;**
- **impart IT competencies, which are playing more and more important roles in occupations, to a broad public;**
- **enable all social groups to benefit from the new media.**

To achieve these aims, we need:

Systematic integration of the new media within teaching and instruction. Schools, companies and higher education institutions must be equipped with the necessary hardware and high-performance network connections. Such equipment must be properly installed, operated and maintained. Teachers must be given suitable IT training.

Use of modern IT and communications technologies - media for the global teaching and research community, at all educational institutions.

Information exchange via intranets and the Internet; instruction modules and study materials that can be provided via the Internet; and virtual libraries that complement regular physical libraries.

Teaching of IT competencies on all levels of training and further training, with the most effective possible use of new media.

Our measures are based on a logically structured concept that takes the various frameworks and tasks of the different relevant areas into account, such as

- Schools
- Vocational training
- Higher education

and that is open – for example, in further training – for intersectoral approaches. The concept also stresses the importance of supporting teaching of media competence and use of IT and communications technologies outside of classical learning sites such as schools, companies, higher education institutions and established further-training institutions.

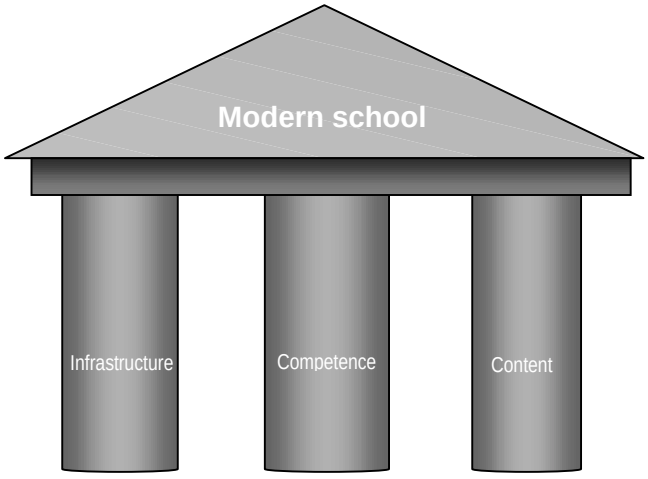
Education is one of the most effective ways to keep society from splitting into groups such as the "connected" and the "disconnected".

## 2. Schools

Knowledge develops in the mind, not on hard disks or in computer networks. In the knowledge society, human beings – not technology – will still be the most important factor. Individual knowledge acquisition, development of skills and competencies and overall personality development – these are tasks that can be accomplished only with the help of education.

Formal education begins in schools. Educational gaps that arise during early schooling can be very difficult to correct later on. Schools must teach competencies in a way that will enable everyone to profit from the knowledge society's opportunities and promise. And such competencies must include the complete range of subject-based, cultural and social competencies needed for success in life.

PCs and the Internet are becoming important tools for working and learning. Schools must thus make PC-based and Internet-based learning a basic part of instruction. This is why the Federal Government's policies in these areas are based on the following three pillars:




- Infrastructure: equipping schools with PCs and Internet access,
- Competence: helping teachers to become IT-competent,
- Content: promoting use of high-quality courseware.

At the same time, concepts must be developed for ensuring that schools' use of IT remains "future-proof".

The Federal Government is implementing its overall concept for IT integration in schools by means of the following instruments:

- **Support programmes** to directly stimulate and support introduction of new media in schools;

- **Various initiatives,** such as *Forum Bildung (Education Forum)*, *Schools go Online (Schulen ans Netz e.V.)* and the *Germany 21 Initiative (Initiative Deutschland 21)*, aimed at linking the various participants and social groups in this effort;
- **Communications platforms,** such as the *German Educational Server (Deutsche Bildungsserver* (DBS) and the sponsors' portal *School Marketplace (Marktplatz für Schulen)* of the Germany 21 Initiative (D21), to facilitate communications, enhance transparency and provide access.

*2.1. Building the necessary infrastructure*

Without PCs and Internet connectivity, schools have no means of engaging in IT-based teaching and learning. Over the past few years, "Schools go Online" (Schulen ans Netz e.V.), an initiative sponsored jointly by the Federal Ministry of Education and Research (BMBF) and Deutsche Telekom, has connected 12,000 schools to the Internet. By next year, further initiative on the part of Deutsche Telekom will enable all schools to connect to the Internet. In addition, Deutsche Telekom is providing 20,000 computers for schools. This will reduce the imbalance between IT use at home and in schools – according to the most recent surveys, over 80 % of all pupils have a PC at home, and 60 % of pupils between the ages of 14 and 19 surf the Internet regularly. Many pupils, therefore, have better PC and Internet access at home than in schools.

Internet connectivity will increase schools' IT requirements. **Without private participation, it will hardly be possible to provide suitable equipment to schools, in all relevant areas**. For this reason, the Federal Government is seeking to generate and strengthen business interest in sponsoring. In particular, it is supporting the Germany 21 (Deutschland 21) initiative, via which over 90 companies, in co-operation with existing initiatives, the Länder and municipal leading associations, want to improve IT use in the educational system. A total of 20,000 long-term sponsorships for schools are to be donated, via a communications platform for sponsoring. To this end, a computer market for new and used PCs for schools has been set up at www.marktplatz-fuer-schulen.de. D21 has declared that its efforts will not be limited to one-time affairs – it wishes to provide lasting support, since only ongoing co-operation with IT experts, sponsors and, of course, with parents can generate the means and know-how needed to provide enough high-quality IT systems to schools so that useful IT instruction can take place. A "no-worry package" has been provided for schools, in order to reduce concerns about additional workloads and expenses. The D21 sponsorship packages thus include planning, installation, training and maintenance.

Infrastructure deficits and technical discontinuities make it difficult for pupils to transfer data and content from school to their home PCs. Computers will not become everyday classroom and homework tools until they can be usefully used at any time and place as necessary. Laptop computers now make it possible for people to carry their work environments with them. Large-scale introduction of pupils' laptop computers in schools must be supported by special financial measures, however, in order to prevent any relevant social imbalances.

Now that the Federal Government has provided a basis for making IT use an everyday part of school life, we need concepts for designing the instruction of the future. Rapid price reductions and enormous technical progress in the IT sector are reducing problems of equipment procurement and operation. Sample solutions of individual municipalities – for example, in projects sponsored by the BMBF – are illustrating ways of facilitating IT use in schools and thus preparing for the future in this area.

There is a lack of fora for systematic information about the best available solutions. In addition, the changes in schools resulting from IT impacts are being inadequately managed. Internet communications platforms in which the Federal Government is involved are being improved in order to support communications between the private and public sectors regarding promising approaches.

There is a confusing array of different educationally relevant Internet services and educational portals. The Federal Government, the Länder and the Deutschland 21 initiative have thus agreed

- to set up a public education portal, the German Education Server (Deutscher Bildungsserver), supported by the Federal Government and the Länder, and
- to establish the D21 portal as the nation-wide portal for relevant public-private partnerships.

These moves are expected to make it easier for educational institutions in Germany to orient themselves in this area and outside of commercial programmes.

### *2.2. Creating competencies*

The Länder (states) have the primary responsibility for providing teachers with IT training and further training. They are called on to emphasise the new media more strongly in teacher training and to make teaching of IT skills a permanent part of teacher training. The Länder have already intensified their efforts in the area of teacher training, and special training courses are now being offered. In addition, progress is being made in changing curricula for

teachers' studies. Nonetheless, training and further training will remain an urgent task for the foreseeable future.

### *2.2.1. Bringing industrial competencies to the schools*

Intensification of IT training for teachers is one of the most urgent projects. Increasingly, companies are supporting the Länder in providing IT training to teachers; one example is the co-operation between the state of Saxony-Anhalt and Intel. The Germany 21 initiative is also supporting such partnerships. The relevant support measures in which the BMBF is involved include innovative training courses in connection with Internet access through the "Schools go Online" programme, which the BMBF and Deutsche Telekom are jointly carrying out. In addition, interested teachers can gain IT qualifications through computer-based or web-based training courses.

IT and Internet use can help make course content more up to date and broader in scope; such systems make it easier to bring the real world into the classroom – the world for which schools prepare their pupils. Links to initiatives of business and industry play a very important role. The Germany 21 Initiative is providing schools around the country with over 1,500 so-called "ambassadors", people who visit schools in order to provide information about jobs in IT and about the relevant qualification opportunities. These efforts also involve use of computers in providing information about the relevant workplace. In addition, schools participating in the "schools, business, working life" ("Schule, Wirtschaft, Arbeitsleben") project are designing Internet projects that, like the "InfoSchul" projects, produce instruction material.

### *2.2.2. Providing special support for female teachers and pupils*

Women are still under-represented in some technical professions, and part of the reason for this can be found in schools. Such under-representation must be avoided in the new media. From the outset, special attention must be given to supporting female pupils and getting female teachers involved.

Currently, the "Schools Go Online" Initiative is primarily reaching male teachers and pupils, since most of the initiative's representatives are IT and mathematics teachers, most of whom are male. Female teachers have thus been under-represented in these efforts. Beginning in mid-2000, industry and business plan to greatly expand their Internet programmes for schools and teachers. Therefore, special courses aimed at teaching female teachers and pupils to use the Internet are urgently required.

In this area, the BMBF is supporting the LeaNet (www.leanet.de) project. LeaNet is expected to become a (self-help) network for all female teachers in the Internet – for women who are just learning how to surf the net as well as for women who already have considerable Internet experience.

Along with LeaNet, a special network for female pupils has been established – the LizzyNet (www.lizzynet.de), which gives girls throughout Germany the opportunity to access the Internet, become involved in network activities and become familiar with Internet technology, including multimedia projects.

The vocational counselling section of the Federal Institute for Employment is also helping to attract women and girls to IT careers. In order to help interest girls in IT careers, comprehensive materials for PCs and special "computer weeks" have been prepared and provided for graduating classes' vocational counselling. In co-operation with business and industry, the Institute also places girls in internships in IT companies.

Agreement has been reached with IBM concerning a pilot project in which female pupils and IT teachers can complete a multi-day "shadow run" within the company and participate in workshops on management and IT skills. Pupils who complete these programmes receive a certificate and can be expected to function as IT mentors and contact persons for their classmates. IBM plans to carry out this project, which is to be expanded to other D21 companies, in early 2001.

### *2.3. Developing content*

The extent to which PCs and the Internet can be used in the classroom depends on the availability of instruction materials. The BMBF is thus supporting, with the "New Media in Education" programme, development of a broadly differentiated range of high-quality teaching and learning software for schools. The programme, which is to run until 2004, is being funded with 100 million DM. This effort is expected to produce robust applications that will support teachers in the classroom. An important aspect is that all content must be reusable and modularly structured so that it can be combined and compiled by teachers as needed.

Network-based learning and teaching means both using and designing multimedia educational content. Schools hold a great deal of unused potential for such activities, as school projects within the framework of the BMBF support focus have shown. In these projects, schools have been developing their first high-quality network-based programmes

and services, in model form. In addition, teaching concepts and technical tools are being produced in over 20 projects in "SEMIK", a support focus of the Bund-Länder Commission for Educational Planning and Research Promotion (BLK), financed by the BMBF, in which use of new media in everyday classroom instruction is being tested.

Teaching and learning materials for the classroom originate not only commercially; a great range of such materials is produced in actual instruction itself. Suitable communications platforms are required that provide information regarding appropriate teaching and learning software. To meet this need, a "Teachers Online" ("Lehrer Online") information exchange has been established within the framework of "Schools Go Online". The "German Education Server", the installation and maintenance of which is funded primarily by the BMBF, provides access to Länder activities. Internet-based teaching programmes are another suitable way of responding quickly and competently to social developments and conflicts that reach into schools. Internet-based course content, which can be shared very quickly and is highly current, can effectively support teaching.

Use of teaching and learning software is going to change schools and learning very quickly. It is important to shape this change. Development of new didactic concepts for future instruction must be supported with suitable scientific research.

### *2.4. Preparing new concepts*

Results to date have shown how important it is to find solutions that limit expenses of the various participating parties in the Federal Government, the Länder and local authorities, also with the help of business and industry. In this area, the Federal Government's primary task must be to moderate technical and organisational solutions and to create possibilities for co-operation between the public and private sectors. Initiatives and communications platforms in this area are thus oriented to a very broad audience.

Direct support is also needed where innovative approaches are concerned. More strongly than before, the BMBF sees its task in supporting and promulgating new usage concepts. As long as every school must define its own computer usage, usage concepts will reach a limited audience. Examples on the municipal level, and school projects funded by the BMBF, illustrate the range of available possibilities for keeping operational costs for school networks within acceptable limits. In co-operation with the BLK, and in co-operation with the German Cities' Assembly (Deutscher Städtetag), with other representatives of school sponsors and with parents, the BMBF plans to develop viable application scenarios for the school of 2005.

This effort will also create the technical and organisational framework for development of professional teaching and learning software.

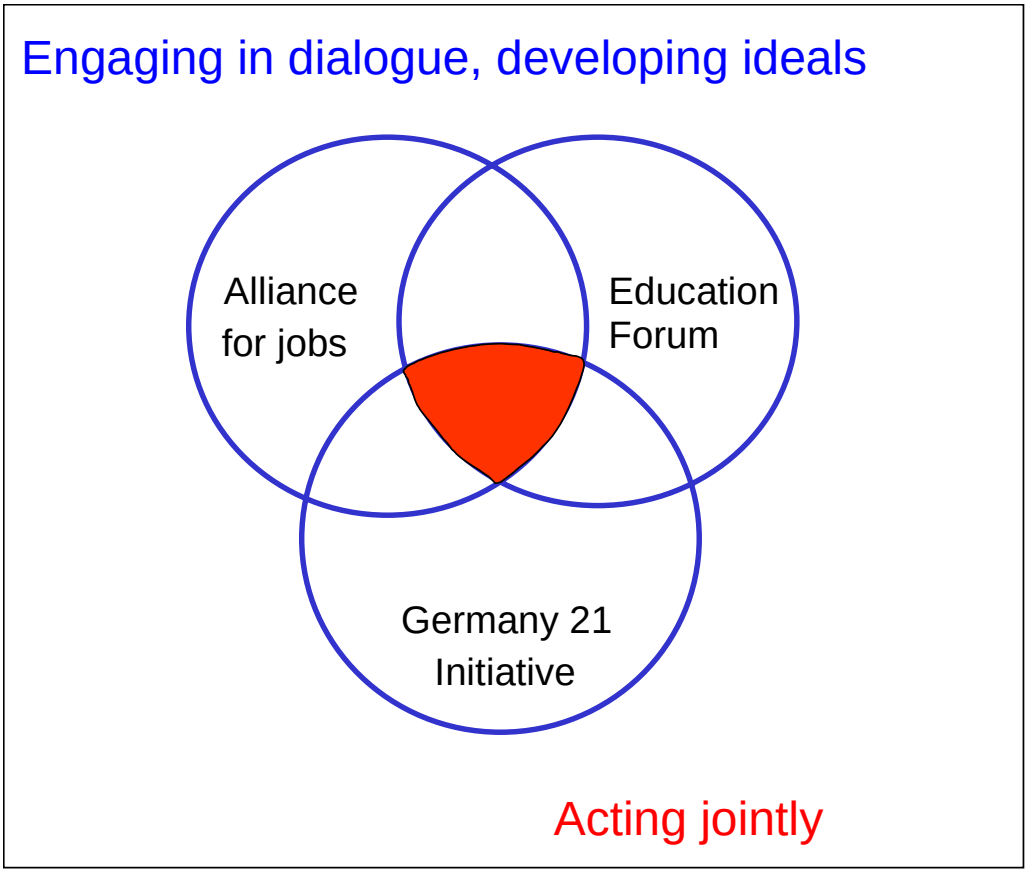
PCs and the Internet must become easier to use – and easier to manage – if they are to be viable tools. This will require intelligent usage concepts. The changes that IT is bringing to schools will be permanent and yet will require ongoing management. This task can be carried out only through joint efforts of the Federal Government, the Länder and local authorities, in co-operation with business and industry.

## 3. Vocational training

The Federal Government is aiming to modernise the vocational training and further-training system and prepare it for the future, so that business and industry and public educational institutions can continue to co-operate in carrying out training tasks, and so that young people can continue to receive modern, up-to-date vocational training.

Use of modern IT and communications technologies has a significant influence on economic progress, and it leaves a lasting imprint on company procedures and structures. Developments in IT and communications are creating new requirements for vocational qualification of employees, while at the same time permitting new forms of in-company training and further training.

As a result of past misassessments and omissions, many of the significant employment and growth opportunities that continue to be provided by the global IT sector remain unused in Germany. A shortage of training places, in combination with serious shortages of skilled employees, shortages of trainers and a lack of further-training concepts, characterises the current situation.



The Federal Government plans to work with the social partners (employers' and employees' organisations) in order to apply the strengths of Germany's dual system of training to the IT sector in an effective way. Germany, a leading economic power, must also be a leader in this area of vocational training. The first steps in this direction were taken within the framework of the Alliance for Jobs and in the founding of the Germany 21 Initiative in the middle of last year. Now, it is important to move forward along this route, with the social partners, and to proceed with modernisation within the framework of a logical overall concept that also includes the results of the Education Forum (Forum Bildung). The Federal Government, in co-operation with business and industry and the unions, has already provided the basis for this effort.
Strengthening of vocational training and further training must emphasise the following:

- Modernising training regulations,
- Creating training places,
- Qualifying trainers,
- Developing and implementing further-training concepts, and
- Using new media in vocational training, even outside of the IT sector.

### *3.1. Modernising training regulations*

Training regulations must be modernised and flexibly designed, in keeping with the fast changes taking place in technology, the workplace and social standards. For companies, modern training and further-training programmes are guarantees of continuing viability.

In defining occupations requiring formal training, the Federal Government will differentiate where possible and develop programmes for additional qualifications, aimed at facilitating commercially useful qualification of young personnel. When necessary, it will quickly identify new occupational profiles and issue the necessary regulations.

Outside of the realm of IT occupations in the narrower sense, use of information technology should become the rule in new and newly regulated occupations requiring formal training. Talks with the social partners to this end have been planned, and will take place in the summer if possible.

### *3.2. Creating training places*

Additional IT training places are urgently required. The target of 40,000 IT training places, as agreed with industry in the Alliance for Jobs in July 1999, will probably be reached this year – two years earlier than promised. In light of the continuing strong demand, the Federal Government has conducted relevant negotiations with industry and reached an agreement calling for the total number of IT training places to be increased to 60,000 by 2003. A central part of this effort will involve interesting more young women in these modern occupations. Young women account for a relatively small percentage of trainees in the four new IT occupations requiring formal training, and their numbers have remained about the same over the past three years.

| | 1997 | 1998 | 1999 | June 2000 – Percentage of women among all applicants |
|---|---|---|---|---|
| IT specialist (Fachinformatikerin) | 12.1% | 11.4% | 11.8% | 9.4% |
| Commercial specialist, general IT (Informatikkauffrau) | 24.0% | 23.0% | 22.8% | 20.4% |
| Electronics specialist, IT systems (IT-System-Elektronikerin) | 4.6% | 4.1% | 3.6% | 2.8% |
| Commercial specialist, IT systems (IT-System-Kauffrau) | 25.8% | 25.9% | 31.0% | 19.6% |

Source: German Office for Statistics, survey for the period 31 December 1997 to 1999; vocational counselling statistics, June 2000

#### *3.2.1. Interesting girls in technical occupations*

Most girls still choose traditional women's occupations. In order to improve girls' own opportunities in the job market, and in order to make additional personnel available to industry and to help eliminate shortages of skilled employees, it is urgently necessary to expand the spectrum of girls' occupational choices. The spectrum must include modern, viable technical occupations – especially IT and media occupations.

"A job is looking for me", a planned game on a multimedia CD-ROM, is a tool for simulating and comparing various career and life choices. It provides information about different occupational areas, including specific occupations, their working and living environments and their development perspectives. Sample occupations are selected in different occupational areas. While the emphasis is on training occupations within the dual system, other types of possibilities for career advancement are also presented. www.joblab.de

#### *3.2.2. Including disadvantaged young people*

It is very important to introduce IT qualifications into the spectrum of available training programmes in occupational support of disadvantaged young people and young adults. Disadvantaged young people must not suffer the double disadvantage, in their training and

occupational opportunities, of finding little or no access to in-company dual training and then, as a result, obtaining no access to modern training content. Positive experience has been gained in qualifying this group in the IT and media area. Projects for providing IT and media skills are now profiting from this experience and are playing a central role within the BMBF programme "New initiatives in support of disadvantaged young people and young adults"; several extensive projects have already been initiated. Teaching of IT and media skills is an emphasis in concepts for improving support structures in assistance for disadvantaged people (vocational orientation, initial training, training preparation, training and additional qualification outside of companies).

### *3.3. Qualifying trainers*

Currently, the most serious hurdle to providing training in IT occupations is a shortage of vocational school teachers and of qualified trainers in companies. According to industrial companies, vocational schools need over 50 % more IT specialists in order to meet the great demand.

The Länder, supported by business and industry, will make every effort to obtain and qualify enough IT trainers in order to reach the agreed target of 60,000 training places by 2003. Following relevant discussion by the Bund-Länder Commission (BLK), the BMBF has initiated a suitable joint procedure, within the D21 framework.

#### *3.3.1. Increasing the numbers of female trainers*

It is important to draw trainers, both male and female, from the group of those who complete programmes and studies for IT occupations. For this reason, one BMBF-sponsored project is focusing on developing and testing a concept for qualifying women in IT occupations as trainers. With the help of suitable case studies, the structural obstacles to equal opportunity for women in IT occupations are being studied, and conclusions relative to successful career planning are being drawn. In close co-operation with companies, chambers of commerce and decision-makers in two regions, possibilities for expanding women's opportunities in IT occupations are being discussed, and relevant perspectives for action are being developed.

#### *3.3.2. Creating networks*

The BMBF also plans to promote suitable approaches for supporting teaching of qualifications for in-company trainers, with IT-based training programmes.

In order to integrate small and medium-sized companies in dual-system IT training, the social partners plan to establish an advising centre that will offer information services for regional

education networks, local IT training associations and state initiatives, that will organise events and that will provide media resources as necessary.

### *3.4. Expanding further-training measures of the Federal Institute for Employment*

The Federal Institute for Employment has increased capacity in its IT-oriented further-training measures from the current participant level, 36,000, to 40,000, and it has expanded the relevant financial framework from 200 million DM to 1.2 billion DM per year. Special consideration is being given to women, who have good employment opportunities in the IT and media sectors.

#### *3.4.1. Expanding models for "dual-system further training for the unemployed"*

A new approach in retraining for IT occupations is being taken in pilot projects carried out by the Essen Vocational Assistance Centre (*Berufsförderungszentrum*). Only one-third of training takes place in an education centre; two-thirds takes place in a company and is supported by network-based forms of learning. This "Essen model" is a good example of how the functioning links between in-company and school training, as found in dual-system initial training, can be transferred to the further-training sector. The social partners have proposed that this model be established nation-wide for retraining measures carried out by the Federal Institute for Employment.

A model developed by the Halle-Leipzig Institute for Structural Political and Economic Promotion (isw), in co-operation with labour administrations in Saxony-Anhalt and Thuringia, provides another good example. Centres for assessing personal, subject-related and job-specific suitability select applicants for qualification programmes in IT companies, oriented to previously identified requirements. Thanks to the thorough, intensive selection procedure and the practical orientation of the qualification measures, participants have good employment opportunities.

### *3.5. Improving further training in companies*

In no other area does knowledge age as quickly as it does in the IT sector. To stay on top of their work, IT specialists – and not only the older ones – must continually update their knowledge. Companies' further-training programmes must be significantly improved, to enable employees, in their everyday work, to quickly adapt their knowledge and skills to changing requirements and technologies.

For this reason, the Federal Government is requiring companies, within the framework of an immediate-action programme to meet requirements for IT specialists in Germany, to enlarge

their in-company further-training programmes in light of Internet-relevant technologies, and to do so significantly, with documentable results.

### *3.6. Developing and implementing a further-training concept*

**Development of a viable concept for vocational further training is the key to a sustainable education and employment policy in the IT sector.**

According to surveys of the Cologne Economic Institute (*Kölner Institut der Wirtschaft*), German industry spends a total of over 34 billion DM on further training. It is estimated that ten billion DM of this amount translate into demand in the further-training market. This demand meets with some 5,000 further-training providers, a considerable percentage of whom specialise in IT training. Nearly 1/3 of the 15 leading providers' total revenue is generated in IT-oriented further training.

The market for IT-oriented further training is becoming increasingly difficult for companies, the Federal Institute for Employment and private customers to analyse. Dissatisfaction is growing:

- Employers and unions have increasingly been complaining about poor programme quality.
- Unclear designations and a broad range of company-specific certificates hamper comparison.
- A further-training concept for IT experts is lacking: technical knowledge in the IT sector quickly becomes obsolete. Every three to five years, IT specialists have to update their knowledge to the latest technical standards, if they wish to succeed in the job market. But experienced specialists no longer require training in basic subject-oriented skills. A system of IT-oriented further training is needed that systematically caters to such requirements for more advanced further training.

#### *3.6.1. Creating a regulatory framework for further training*

The BMBF has arranged for the Federal Institute for Vocational Training (BIBB) to carry out a regulatory procedure aimed at structuring the further-training system in this connection – in order to make possible systematic, consecutively structured high-quality, modular, IT-oriented further qualification for leavers from IT occupations, for lateral entrants and for higher education graduates.

The aim is an IT-oriented further training system that is based on real work processes in the IT sector, that builds on IT training or equivalent practical experience, and that will permit certification of further-training programmes.

The social partners, industry and company representatives, and experts from IT manufacturers and from the various application sectors are all being included in this effort, in order to ensure that the full range of qualification requirements is met. **Preparations for this effort will be completed in the coming weeks; then, preparation of a draft ordinance**, regulating testing requirements and qualifications, will begin. Work to date has described a number of different activity profiles, and has concentrated these profiles into about two dozen specialists' profiles. These profiles also represent standards for job descriptions and qualification paths in information technology.

The IT sector is changing so quickly, however, that it is not possible to obtain a complete, up-to-date picture of the training content. Although standardised further-training programmes take fast technological change into account, they have to be modified at intervals shorter than those with which the state functions. Flexible further-training modules are thus required that meet momentary requirements in the IT sector (such as new programming languages, technologies). Parallel development of open curricula that permit integration of different training providers' content is expected to respond to this need. Such additional qualifications, which will not be a direct part of regulated further training, must be integrated within the further-training system and must be of assured quality. Suitable instruments for this approach must be developed. This is the only way to ensure that employees' qualifications and skills meet the IT sector's future requirements.

The unprecedented regulation procedure for IT-oriented further training, previously an unregulated area, will thus create one of the world's best further-training systems for IT.

*3.6.2. Teaching with multimedia*

**The BMBF, in co-operation with the social partners, is supporting development of the relevant curricula and development of the relevant courseware**. The approach is unprecedented: parallel to the regulation procedure and the curriculum development, the Fraunhofer Society (management: Fraunhofer Institute for Software and System Technology, ISST), in co-operation with educational experts, will develop the relevant teaching and learning software needed as a basis for development of network-based further-training programmes, following completion of the regulation procedure (the first). The content is being designed to be adaptable to established measures of further-training sponsors, including

those of the the Federal Institute for Employment, as well as to in-company further-training courses.

*3.6.3. Linking further training and initial training; overcoming barriers*

The aim of the IT-oriented further-training concept is to create content and certification structures that all important partners accept and, in a second step, to provide stronger methodological links between the further-training concept and initial training.

Another aim must also be to integrate the vocational schools. In the dual system of vocational training, many vocational schools, in many subject areas, use the same sorts of IT systems for their instruction that are used in relevant companies. The desired modularity of multimedia training content should also mean that use of the new media leads to integrated, occupation-specific training programmes that can be applied to both in-company and vocational-school training.

The system's modular structure, oriented more strongly to activity profiles than to occupational descriptions, will permit use of the system in a wide range of different occupations and learning sites. This fact, along with extensive availability of the relevant software as open source software, should make it possible to use the system in other countries as well.

*3.6.4. Getting off to a quick start*

In the next few days, the BMBF plans to approve the project's main phase, calling for development of curricula and teaching and learning software. **This also represents the start of the vocational training emphasis in the "New Media in Education" programme**.

*3.7. Using new media in vocational training, even outside of the IT sector*

Now, it is also important to develop similar solutions for other sectors, solutions that meet the various different needs. In such areas, we need specially tailored training programmes. As in programmes for the IT sector, efforts must begin with analysis of existing programmes and concepts: where are the most urgent requirements – in initial training or in further training? How can the two (in a second step) be linked? How can existing programmes and providers be integrated?

The BMBF is engaged in talks with various sectors – currently, with the automotive and chemicals industries. The emphasis has to be on employment-intensive and rapidly growing industries; the aim in each case is to develop an overall concept and then implement it on a

large, broad scale. Federal funding of 100 million DM, for the period from 2000 to 2004, has been earmarked for the vocational training emphasis within the "New Media in Education" support programme.

### *3.8. Promoting widespread network-based learning*

Technology and the markets are changing so fast that training content must be integrated within the workplace in "near-real time". On-the-job training, with the help of modern information and communications technologies, provides direct access to current content that can be directly integrated within the work process. Modular design of course content makes it possible to select programmes individually and makes programmes highly reusable.

#### *3.8.1. Integrating medium-sized companies*

An analysis of the potential for network-based learning in small and medium-sized companies, which was carried out in 1999 under contract to the Federal Government, revealed that nearly one in four medium-sized companies are already using multimedia in their further training. An additional 17 % are currently planning to use multimedia learning tools. On the other hand, only 7 % are now using the Internet as part of their further training. Small and medium-sized companies thus have a considerable range of unused opportunities to satisfy their constantly growing employee-training needs flexibly and cost-effectively.

#### *3.8.2. Promoting and promulgating best practice*

This is why the Federal Ministry of Economics and Technology has launched LERNET– a competition for network-based learning in medium-sized companies and in public administrations. The purpose of the competition is to promote development and testing of network-based learning in small and medium-sized companies and in public administrations. LERNET is expected to help promote best-practice examples that contribute to development and distribution of new forms of further training and encourage emulation.

#### *3.8.3. Creating structures and tools for broad use of multimedia in learning*

In the lead project "$L^3$ – Lifelong Learning", an infrastructure for multimedia teaching and learning in education centres and in the workplace was developed. This infrastructure, which is suitable for everyday use, is being tested in a first range of courses in education centres. It is making self-paced and teletutor-supported learning in the workplace and in network-based training associations a reality. It is giving SMEs access to efficient forms of multimedia training that previously were available mainly to large companies.

*3.8.4. Linking crafts' training sites*

Just a few days ago, the BMBF approved support for a network for development and use of network-based, location-independent qualification modules in crafts' training centres. The network is providing a learning environment with which multimedia teaching and learning can be adapted to the diverse needs of training sites and, as a result, to individual learning in the workplace or at home.

*3.9. Drawing on resources of research establishments*

We must do more to make research establishments' resources available for further training. The Fraunhofer Society (FhG) and the GMD – Forschungszentrum Informationstechnik (GMD research centre for information technology) are thus jointly building, with financial support from the BMBF, a further-training platform that will offer multimedia-based training programmes, based on existing competencies, and help establish them in the market.

In addition, FhG's/GMD's IT competence is to be applied to co-operative efforts for development of teaching and learning software, especially software for use in vocational training. New business opportunities are emerging in this area. The FhG's key participation in work on the IT-oriented further-training system is an important first step toward this new business area.

*3.10. Enhancing quality of further-training programmes*

The aim of the IT-oriented further-training concept being funded by the BMBF is to protect programme quality in the long term. Even if this certification system will cover an important part of the further-training market, it still applies to a quantitatively small section of the market:

- The 15 leading further-training providers generate over 2/3 of their revenue outside of the IT sector,
- The IT-oriented further-training system will still leave ample room for training programmes that teach IT skills.

Voluntary self-monitoring and issue of seals of quality by industry associations, as carried out by the German Multimedia Association (Deutsche Multimedia Verband - dmmv), in co-operation with the Federal Government, are good ways of providing users with quality standards.

In addition, we need independent assessments – of the sort commonly available for other market products and services.

The BMBF thus intends to have Stiftung Warentest [a product-testing and consumer advocacy organisation] to test further-training programmes for efficiency and quality. In the Federal Government's view, quality assurance is a necessary prerequisite for sustainable growth in the further-training market.

*3.11. Making use of employment opportunities now*

Many of the measures in this overall "IT in vocational training" concept, which was developed with the social partners, will affect the job market, and develop potential for economic growth, only in the medium or long term. Rapid action, as taken in the Federal Government's and IT/communications sector's immediate-action programme aimed at meeting requirements for IT specialists in Germany, was necessary, however: an acute shortage of IT specialists made it necessary to issue temporary residence permits for foreign IT specialists as a way of strengthening Germany's position in the IT sector.

The above-described vocational training and further-training measures will help ensure that Germany has enough adequately qualified personnel to satisfy the demands of the fast-growing IT job market.

# 4. Higher education

The Federal Government is promoting widespread use of modern information and communications technologies, and it is supporting systematic use of electronic and multimedia-based information-presentation systems in higher-education research and teaching. But higher education institutions are not only users and developers of information and communications technologies; they also teach IT competence in all subject areas, especially in training of IT specialists. In light of this position, the BMBF, in co-operation with the Länder, is supporting higher education institutions in four ways:

in **building infrastructure,**

in **developing new teaching and learning concepts,**

in **developing content software for higher education teaching,**

in **developing concepts for a German Virtual University and**

in **strengthening IT training at higher education institutions.**

## *4.1. Building IT infrastructure*

While IT use is nothing new in higher education, it remains a highly current topic for higher education institutions.

The higher education IT infrastructure has been built by the Federal Government and the Länder, within the framework of the Joint Task "Higher Education Construction" (Hochschulbau). All of Germany's universities are connected to the Internet. In 2000, Germany's science, research and education sectors are receiving the world's most modern network infrastructure, the gigabit science network, the German Internet 2. With the support of the BMBF, the "German Science Network" (Deutsches Forschungsnetz), which links all of Germany's research establishments and universities, has been upgraded in recent months into a high-performance network with transmission speeds in the gigabit range[1]. It now supports a broad range of multimedia applications and services: lectures can now be transmitted in real time to classrooms and auditoriums throughout the country. As a result, Germany now has much of the necessary basis for national, multimedia-based learning programmes.

But national links are not the only important consideration. Students must be able to access the network, and their learning programmes, from any location within their universities. Increasing usage of laptop computers, and the resulting continual availability of networks and

[1] Funding: 85 million DM in five years

their full functionalities, will enable new forms of learning to develop in higher education institutions and make information technologies an everyday part of university life.

The BMBF therefore intends to provide at least 5 million DM in 2000[2] in support of **demonstration projects for wireless networks (WLAN)** of higher education institutions. This support is being provided for initial installation of wireless network infrastructures, available to both students and teaching and administrative personnel, at one to two universities per state. The relevant selection process in the Länder is currently under way.

*4.1.1. Providing access to specialised information*

One important structural basis is an Internet-based **"Digital library"**. Freedom from time and place constraints in using scientific publications, and the ability to find relevant information quickly and efficiently, is becoming a decisive competitive factor for scientists and university students alike. The aim is to provide desktop access to the world's fund of scientific and technical information. The "digital library" actually refers to work-sharing, linked electronic information systems. Over the past five years, within the framework of the **SUBITO** Federal-Länder initiative, a powerful library document-delivery service has been created that supports online research and delivers technical literature directly to the users' PC desktops. Further expansion will concentrate primarily on enlarging the range of available electronic publications.

*4.1.2. Shaping the future of scientific and technical information*

In addition to these support measures, the BMBF is planning to prepare a strategy concept entitled "Future of scientific and technical information". This effort will focus on fundamental issues of relevance to rapid technological change and will seek to identify relevant new approaches and structures for the future. The strategy concept is expected to identify needs for further action and to serve as a guide for co-ordinated support policy of the Federal Government, the Länder and other support institutions. It will also provide recommendations for all parties involved in production, distribution and use of scientific information. The basis for this strategy concept is being developed within the framework of a one-year study that is aiming to analyse international trends, along with various perspectives and assessments regarding the future of scientific/technical information, and to derive relevant implementation scenarios.

[2] http://www.gmd.de/NMB/PT-NMB.html

*4.2. Developing new teaching and learning concepts*

Whereas use of information technology has long been standard practice in research, the current aim is to use new media in higher education teaching. The Federal Government and the Länder agree on this. Joint efforts have already been undertaken in this area, such as the soon-to-be-completed HSP III, which has provided a total of 240 million DM in support, and the BLK[3] support emphasis "Online studies and new media in teaching".

Integration of new media in higher education teaching brings up important issues of studies reform, including teaching quality, accreditation and certification, quality assurance and shortening of the average duration of studies. In addition to production of teaching and learning software, this area also concerns fast integration of new media in higher education (both in teaching and in everyday university life), use of all media for imparting knowledge (for example, in interactive lectures and virtual laboratories) and use of the latest information in training and further training.

Over a year ago, in order to reach these aims, the BMBF began supporting lead projects with a pioneering role in use of new media in higher education teaching and, thus, in relevant long-term changes in the higher education sector.

The **lead project "Networked Chemistry Studies"**[4] is focused on creating nation-wide links between various areas of chemistry. This project seeks to create a new learning concept in which a network of content gives students a new type of access to chemistry studies. This project, which is scheduled to run for five years and has funding of over 40 million DM, is one of the most ambitious higher education projects of the past few years. A total of 16 instructors, at 13 universities in 8 Länder, are co-operating in the project. FIZ Chemie (Specialized Information Centre Chemistry) is responsible for the relevant technical and organisational management.

This lead project demonstrates exemplary treatment of important principles for co-operation between universities, covering such aspects as co-operation agreements, regulation of copyrights and usage rights and long-term use of findings. These principles served as a guide for a recent invitation to tender that was issued within the framework of the support

[3] http://www.blk-bonn.de/fernstudium.htm. The results have been published in the reports of the State-Secretary Working Group "Multimedia im Hochschulwesen" ("Multimedia in Higher Education"). The first report, dated 9 March 1998, is available at http://www.blk-bonn.de/papers/heft63.pdf
The second report, dated 7 June 1999, is available at http://www.blk-bonn.de/papers/heft76.pdf
The third report, dated 19 June 2000, is available at http://www.blk-bonn.de/multimedia.htm; (this document will soon be available for download)

[4] http://www.vernetztes-studium.de/de/

programme "New Media in Education"[5] for the higher education sector. A total of 200 million DM in federal funding has been earmarked for this programme section through 2004.

An important aim of the **"Virtual Fachhochschule (VFH)"** project is to use the Internet and multimedia systems in order to strengthen the competitiveness of Fachhochschulen (universities of applied sciences) in the future education market. This is to be accomplished primarily by developing new target groups and markets, under the assumption that the education market can be expected to grow significantly as a result of requirements for lifelong learning. Two courses of studies – economic engineering and media IT – will be offered, on both basic and advanced levels. Within an open concept approach, modular multimedia online courses will be offered, and existing courses will be used to provide the latest knowledge available world-wide, on the basis of the internationally recognised credit-point system.

This programme is aimed at students who prefer virtual studies, either in light of their personal life situations or because they are attracted to open, interactive studies. The programme is also aimed at employed people, however: people already in working life will be able to access specific modules in order to further their training. The various Fachhochschulen involved in the relevant consortium have developed the first modules for the curriculum, and these modules are now being tested and evaluated in practice.

The "Virtual Fachhochschule" project, which is being co-ordinated by the Fachhochschule Lübeck, is being carried out by a consortium of 11 Fachhochschulen and two universities, from eight Länder, and by other partners, including industry partners. In addition to technical aspects of virtual studies conducted with new information and communications technologies, the project is also emphasising the aspect of a virtual organisation supported by all participating partners. The BMBF is providing 43 million DM in funding for the project.

### *4.3. Developing teaching and learning software for higher education*

The current need for action in higher education policy has relatively little to do with support and channelling of development of the necessary technical basis. The real challenge lies in designing content and in developing usage concepts. Higher education institutions now have the opportunity to use information and communications technologies in order to improve teaching quality, to increase the percentages and amounts of guided/supported self-study, to develop new online studies programmes and new combinations of classroom teaching and

[5] http://www.gmd.de/NMB/PT-NMB.html

self-paced/online studies and to create new further-training/continuing-education programmes.

An **invitation to tender within the framework of the programme "New Media in Education"** called on higher education institutions to submit projects for development, testing, introduction and long-term use of innovative forms of multimedia teaching and learning, to be carried out in inter-Länder efforts. The efforts were to have a bottom-up approach, based on voluntary networks of higher education institutions.

The large number of submitted project outlines, and the broad subject spectrum covered by the applicants, including applications outside of natural and engineering sciences, attested to a very strong response. Submissions characteristically focused on formation of inter-Länder associations of higher education instructors, for work-sharing development of teaching and learning modules for lectures, seminars and practical exercises. Many chose the open-source principle for distribution and management. This good technical basis, along with fast assessment and approval, is now permitting projects to get underway quickly.

### *4.4. Developing new markets via the virtual university*

The new media permit world-wide distribution of knowledge and education content, free of any time and place constraints. This will open up new dimensions in competition between education providers. Education programmes of foreign providers in particular, available through the web, are meeting with rapidly growing demand. Many German universities are still showing considerable restraint in this area. German universities must be encouraged to join forces and actively participate in this competition.

The results of the BMBF's invitation to tender, within the framework of the "New Media in Education" programme, show that many faculties at German universities are highly interested in developing the full potential of virtual instruction. Many projects are already underway, partly on the basis of previous support and partly on the strength of basic higher education funding. Additional years of intensive start-up financing will be needed to create viable programmes and structures, however, financing such as is included in this BMBF programme.

These projects are outlining the long-term potential of the virtual university. The virtual university will be generated through large-scale integration of virtual content in teaching, inter-university development of teaching/learning systems and knowledge databases and integration of such systems and databases within an individualised, demand-oriented range

of programmes. This also means, however, that universities will have to focus more strongly on those people who have left their community – employed graduates. Higher education institutions must not confine themselves to issuing conventional higher education qualifications; instead, they must join in developing the international further-training/continuing-education market.

This effort must be supported by new approaches in marketing virtual studies. Service providers must emerge to offer self-paced and online studies that include teaching and certification from one source.

All of this could take place within the framework of a **German Virtual University**. The BMBF intends to support relevant concept development, in co-operation with the Länder, and to support implementation of promising concept ideas.

### *4.5. Strengthening IT education at higher education institutions*

As important as these strategically oriented projects are, it is also necessary to respond flexibly to the latest requirements. To meet industry's urgent requirements for additional IT specialists, and especially to help higher education institutions keep up with the sharply increasing demand for relevant education, the Federal Government and the Länder have launched an **immediate-action programme for upgrading IT studies at Germany's higher education institutions (Sofortprogramm zur Weiterentwicklung des Informatikstudiums an den Hochschulen in Deutschland – WIS)**. This programme is aimed at creating additional training capacities, shortening the average duration of studies and facilitating the development and testing of new courses of studies leading to bachelor's and master's degrees and of continuing education programmes at universities.

#### *4.5.1. Campaign for women in engineering: "Be.Ing - in future with women"*

Women are still greatly under-represented in engineering and IT studies. In order to encourage more women to undertake such studies, in December 1999 the BMBF launched the information campaign "Be.Ing"[6], which is aimed primarily at young women making their career decisions, as well as at entrepreneurs and universities, and which advertises in conventional media. As a result of this advertising, and of publicity in an accompanying Internet platform and in campaigns in schools, the overall campaign has been very effective. A "Meet.Ing!" event held in May 2000 in Berlin also provided a look at various relevant careers. It gave some 450 female pupils and teachers the opportunity to meet with engineers

[6] Translator's note: "Be.Ing" is a combination of the German words "Beruf" (career) and "Ingenieurwesen" (engineering), with a structure that recalls the German "Dipl.-Ing" and "Dr.-Ing" (engineering degrees). It also brings to mind the English word "being", which any young German will know.

and information technology specialists (both men and women), with female engineering and IT students and with representatives of companies and universities. It also offered workshops on relevant studies and on engineering and IT careers.

### *4.5.2. Supporting female students*

Another important aim is to interest more young women in research careers and, thus, to attract more women to IT studies. To this end, the University of Bremen plans to offer a women's IT studies programme beginning in the winter semester of 2000. A project entitled "Mentoring Programm für Frauen in der Informatik" ("Mentoring programme for women in IT") (MUFFIN, http://borneo.gmd.de/MUFFIN), being carried out jointly by GMD and the University of Bremen, in co-operation with the Informatica Feminale summer university, is focusing on mentoring and career planning for women. The project is being expanded to include the D21 companies, and female researchers and developers from IBM are serving as mentors.

## 5. Enabling everyone to participate

Information and communications technologies are changing society very rapidly. Increasingly, private, professional, economic and political life is taking place via and in the Internet. The spectrum of relevant activities ranges from e-mail communications to home banking to electronic voting.

The Federal Government's expressed overarching aim in the action programme "Innovation and Jobs in the Information Society" is to ensure that all social groups benefit from the new media. Experience in the U.S. already points to disparity in Internet access and use of new media. This disparity is being intensively discussed in the U.S., where it is referred to as the "digital divide". Current figures on Internet use point to an emerging division in German society. Internet usage differs very widely across different demographic groups. Internet use among women is 10 % lower than in the population as a whole. Younger and better educated people continued to be over-represented.

Breakdown of users by sex

| Sex | July 1999 | Jan. 2000 |
|---|---|---|
| Male | 66 % | 61 % |
| Female | 34 % | 39 % |

Source: GfK online Monitor, 18 August 1999 and 22 February 2000

Breakdown of users by age

| Age: | July 1999 | Jan. 2000* |
|---|---|---|
| 14 to 19 | 1.7 million | 2.8 million (60 %) |
| 20 to 29 | 2.8 million | 3.9 million (47 %) |
| 30 to 39 | 2.6 million | 3.9 million (34 %) |
| 40 to 49 | 1.8 million | 2.9 million (29 %) |
| 50 to 59 | 1.0 million | 1.9 million (19 %) |
| 60 to 69 | k. A. | 0.4 million (5 %) |

Source: GfK online Monitor, 18 August 1999 and 22 February 2000

* in parentheses: percentage of Internet users in the relevant age group

Breakdown of users by education

| School qualification | Users in January 2000 | Entire population |
|---|---|---|
| Secondary modern school (Hauptschule) | 26 % | 45 % |
| Intermediate high-school certificate (Mittlere Reife) | 38 % | 34 % |
| General university entrance certificate (Abitur) | 19 % | 11 % |
| University degree | 17 % | 10 % |

Source: GfK online Monitor, 18 August 1999 and 22 February 2000

It is crucially important to prevent any division into the "connected" and the "disconnected". This especially involves:

- facilitating access to new media
- enhancing citizens' media competence.

*5.1. Facilitating access to new media*

In the framework of the "Schools Go Online" initiative, the BMBF plans to join with the German Library Association (Deutscher Bibliotheksverband) and Deutsche Telekom to equip 700 public libraries with media corners. This initiative seeks to facilitate access to new media for people who cannot afford computers or Internet use. Rural areas, in particular, lack such resources. The programme will also offer pupils public afternoon access to new media. Finally, it will also enhance libraries' education- and social-policy importance and improve acceptance of new technology.

*5.2. Interesting women in IT*

In Germany, the Internet stopped being a male-only domain quite some time ago. Over one-third of all women are already online. In the second half of 1999, the percentage of women who are online grew by 5%, to 39%. This positive trend is continuing in 2000. The BMBF's joint activities with other initiatives are having an effect.

The joint campaign in the Initiative "Women give new impetus to technology", which ran in late September 1999 – with the support of the Federal Ministry of Education and Research (BMBF), the Federal Institute for Employment, Deutsche Telekom and "Brigitte", a women's magazine – offered women free entry-level courses on the Internet, in a total of 101 cities. The relevant statistics reflect the enormous response that this effort generated: the "Frauen

ans Netz" ("Women Go Online") Web site registered over 3.5 million hits, and over 40,000 women have now taken part in the courses.

In spring 2000, more intensive practical courses (surfing and searching) were offered. A follow-on campaign calls for alternating entry-level and practical courses and is scheduled to run until the end of 2001. By that time, women are expected to account for 50 % of all Internet users.

The most important aim of this measure was to acquaint women with the Internet, in courses for women only, taught by female instructors. This completed campaign, and future campaigns, are expected to help women – well-educated working women as well as women with little opportunity for Internet access, women with families and women with few employment opportunities – to recognise the benefits of the Internet and learn to use it effectively in their future training and further training. The nation-wide campaign's Internet address is www.frauen-ans-netz.de.

*5.2.1. Building a competence centre*

The "Women give new impetus to technology" association was founded on 10 November 1999. This association's main aim and purpose is to make better use of women's potential for shaping the information society and technology and to create equal opportunity in these areas, for men and women. A competence centre for work toward this aim has been established, co-ordinated by an Institute at the Fachhochschule Bielefeld. This centre opened on 1 April 2000.

This centre is functioning as a clearinghouse for all equal-opportunity measures in areas entitled "Opportunities for Access", "Education in Schools and outside of Schools", "Vocational Training / Further Training", "Higher Education", "Science and Research" and "Careers and the Workplace". www.kompetenzz.de

*5.3. Integrating senior citizens*

Education is one of the most important ways of combating any digital divide. All of the above-described concepts and measures in the areas of schools, vocational training and higher education are part of this picture. But we must also remember those who are no longer in formal education or who are working in careers.

Within the framework of the Information Society Forum[7], the Federal Government has focused intensely, in co-operation with associations, clubs and interest groups for Germany's senior citizens, on the older generation's special needs in the knowledge society.

The following aims and framework have been developed:

- Initiation and support of broad-based efforts to reduce the older generation's wariness of, and distaste for, IT products and services, and to increase this generation's media competence.
- Support for measures aimed at promoting nation-wide and Europe-wide dialogue, among senior citizens, regarding use of the new technologies.
- Increasing IT companies' awareness for the needs of older people, especially with respect to user-friendly interface design and support of suitable projects and development efforts.

In addition to facilitating citizens' access to new media and strengthening citizens' media competence, we must:

- Help citizens participate in the democratic development of the Internet and in other decision-making processes in the multimedia realm.
- Increase citizens' awareness of the benefits of modern information and communications technologies.

[7] The Information Society Forum (Forum Informationsgesellschaft) is an initiative of the Federal Government. "Senior Citizens" ("Seniorinnen und Senioren") is one of the forum's 6 working groups.