OECD/CERI ICT PROGRAMME
ICT and the Quality of Learning

Case Studies of ICT and School Improvement in Germany
Executive Summary

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2. Introduction

The survey presented here is part of the international ICT program *"ICT and the Quality of Learning"*, carried out by the *Centre for Educational Research and Innovation (CERI)* of the *Organisation for Economic Co-operation and Development (OECD)*. Germany participated in this program on the qualitative partial study *"Case Studies of Organisational Change"*. A total of 23 states based their work on the *Workbook for Case Studies of Organisational Change* , and collected data at three to six schools in each state using the same instruments (interview

guidelines and questionnaires) which were then evaluated in compliance with a defined plan. The survey was carried out in Germany from August 2000 to January 2001.

3. The Educational System in the Federal Republic of Germany

The following brief introduction to the educational system in the Federal Republic of Germany is to provide a background to the schools audited in the survey. The educational system in Germany can be divided into general schools and vocational schools whereby the vocational schools combine educational and in-company training, an arrangement therefore known as the Dual System.

The general school system in Germany is divided into three sectors. After the primary level which usually lasts for a period of 4 years (primary school), and which must be attended by all students, the system is divided up into a secondary level comprising three types of secondary schools, the Hauptschule (*general secondary school)* and the Realschule (*secondary modern school)* both representing the secondary level I, and the Gymnasium (*grammar school)* comprising secondary level I and II. These three types of school usually commence with grade 5.*(the 5th year of education , the child is around the age of 10-11)* (In a few Federal states there is still an orientation level , e.g. in Lower Saxony, Hesse and in some schools in North-Rhine Westphalia. This independent school type comprises grades 5 and 6 and is followed by secondary school). In addition, there is a Gesamtschule (*comprehensive school)* which has all three school types Hauptschule, Realschule and Gymnasium under one roof. Students are, as a rule, taught as a complete class group and in certain subjects according to the school they have been assigned to. The percentage of comprehensive schools among the other general school types is very small.

Compulsory schooling in Germany is 12 to 13 years. The grammar school and the comprehensive school have the longest period of 13 years. Grades are counted from 1 beginning with the first grade in primary school. The final school leaving certificate at the grammar school is known as "Abitur" and is a qualification to attend university. The Hauptschule ends after 9 years of schooling after which a vocational training can be started in combination with a vocational school. The Realschule finishes after a school time of 10 years with the Mittlere Reife (*a general certificate of secondary education)* which is a qualification for vocational training with an apprenticeship or for a transfer to a Gymnasium. There is additionally a tertiary level comprising universities, vocational apprenticed training within the Dual System and further education which are looked on as institutions for initial vocational training and set apart from other general schools.

Students at the Hauptschule frequently come from high-poverty backgrounds. Lessons in the Hauptschule tend to be of a practical nature, preparing the students for certain jobs which means that these students must be assessed in a different way from students at a Realschule or Gymnasium. The cognitive performance of Hauptschule students is often lower and less successful than students in other types of schools.

4. ICT in the German educational system

The Federal Republic of Germany is divided into 16 Länder or federal states each having its own Ministry of Education and the arts (Kultusministerium) responsible for school affairs in its own autonomy. In each state, curricula are created for the schools in that state which means that with regard to the inclusion of ICT in German schools there can be no uniform curricula in the schools. For the time being, most states have prescribed contents for lessons in computer science but this does not usually come into force until from grade 7 to 9 and then it is, as a rule, a optional compulsory subject of choice. This means that computer science at school is not an obligatory subject for all students. Didactic concepts and the anchoring of ICT in obligatory lessons is not yet prescribed throughout all of Germany. However, some states have started to integrate ICT into obligatory lessons.

The infrastructure regarding ICT in schools in Germany has been provided among other means by the project *Schulen ans Netz* of the *Bundesministeriums für Bildung und Forschung* (BMBF) in co-operation with the *Deutschen Telekom AG*, an initiative and other financial assistance through which many schools in Germany were able to procure modern computers and peripheral equipment. In the meantime, almost all schools were networked free of charge and have also free access to Internet. Further regional and national promotions assist schools in the initial procurement and expansion of their ICT infrastructure. However, it can be said that the infrastructure in German schools is not yet adequate and the schools must endeavour to find sponsors to provide them with financial and material means.

5. Schools selected for the OECD survey

For the OECD survey in Germany, five schools were selected which had already integrated ICT into their curricula and were working with it innovatively: the Freiherr-vom-Stein-Schule (Pilot study), Hessisch Lichtenau (Central Germany); the IGS Bonn-Beuel, Bonn (West Germany); the Grammar School O., O., (South Germany); the Albanischule, Göttingen (Central Germany); und die Jules-Verne-Schule, Berlin (East Germany). Besides being of different types, the schools also represent different territorial areas of Germany and included a grammar school, three comprehensive schools (Freiherr-vom-Stein-Schule, IGS Bonn-Beuel, Jules-Verne-Schule) und a primary school. (Albanischule)

6. Conclusion to the Hypotheses

The following conclusions were drawn for the hypotheses from data and results from the audited schools:

1. **Hypothesis: Technology is a strong catalyst for educational innovation and improvement, especially when the World Wide Web is involved. The rival hypothesis is that where true school-wide improvement is found, technology served only as an additional resource and not as a catalyst, that the forces that drove the improvements also drove the application of technology to specific educational**

problems.

It was observed that ICT was often used in lessons in which the teacher worked with new teaching and learning methods and new lesson concepts. Teachers who work with ICT in their lessons emphasized that conventional teaching methods must be changed in order to integrate ICT appropriate into lessons. Increased forms of group work are made possible as well as project-based learning. This new methods bring about a change in the roles of students and teachers. ICT functions as a catalyst giving rise to new learning and teaching methods. Changes arising from ICT often are parallel to changes in pedagogy, involving, however, varying teacher groups and interest groups.

The rival hypothesis is that most schools initially began with pedagogical innovations or an extensive school development process in which ICT was only partly included or subsequently as an additional tool. ICT was merely an innovation and served in the main as a search instrument for information, as a medial illustration of subject matter, for learning computer science and for text creation. This way of handling ICT inevitably leads to innovations and changes. ICT in this form could lead to teachers creating further innovative ideas, but does not necessarily do so.

From those schools included in the survey it can be said that the rival hypothesis up to now is more strongly visible as not all schools working with ICT have introduced new teaching methods. Pedagogical innovation, however, played a major role in the audited schools, independent of ICT although it is assumed that the more ICT is diffused through the schools, the more innovative teaching methods there will be.

1. **Hypothesis: The diffusion of the innovation/ improvement (and therefore of ICT) followed the traditional diffusion pattern for innovations, as outlined by ROGERS (1995). The rival hypothesis is that technology functions differently from traditional innovations and that therefore different patterns occur.**

A variety of reasons speak for the diffusion of innovations in schools as outlined by ROGERS. In all of the schools, innovations were initiated and motivated by convinced and committed teachers. As a rule, this led in the event of resistance to the formation of smaller groups who further diffused the innovations throughout the school. These groups contributed to the implementation and definition of innovations so that gradually the innovations could be established among other persons in the school. Nevertheless, some teachers used the integration of ICT for their own relative advantages such as personal interests, securing their workplace for the future, career advancements, recognition and job satisfaction, job facilitations etc. In addition to knowing that ICT is time-consuming, many teachers see the complex and complicated technology as further obstacles. Teachers can overcome their apprehension of it by making the acquaintance of the technology at home in their own four walls. Bringing teachers together in a "teacher team" promotes increased use of ICT in lesson, ICT knowledge and skills can be passed on to others quickly. During normal diffusion, more and more teachers were induced to contribute their opinions having been spurned on by a few of the trailblazers. No diffusion patterns in the sense of the rival hypothesis were observed.

1. **Hypothesis: Successful implementation of ICT depends mostly upon staff competence in the integration of ICT into instruction and learning. This hypothesis assumes that teachers mediate ICT applications when they are successful, and that ICT`s academic value relates positively to teacher competence. The rival hypothesis**

is that the school technological infrastructure and student ICT competence rather than staff competence determine ICT implementation outcomes.

Successful implementation of ICT would appear at first not to be dependent on infrastructure. Schools with adequate infrastructure did not display ICT use in lessons throughout the whole school. However, it was observed that where schools increased teacher skills in ICT through training, ICT use in lessons likewise increased. Teachers who felt insecure handling ICT used the media relatively seldom in their lessons. To carry out innovative projects, teachers need comprehensive know-how or the support of outside helpers. According to answers given concerning the integration of ICT in lessons and the design of learning scenarios, teacher competence is a decisive factor. However, this does not solely depend on the teacher s ICT skills but also on their ability to make the most benefit of the computer s specific qualities and to integrate them into their lessons. As the available infrastructure improves and increases, so do the ICT skills of the teacher.

The rival hypothesis is supported by observations that teachers are put off using the computers when the equipment is often defect or, vice-versa, a high-quality infrastructure (state-of-the-art hardware and software, sufficient equipment and time, stable systems etc.) motivated teachers to use them. Both teachers and students work with more motivation on equipment which is modern and efficient and is available in sufficient quantities. Control software also provides teachers additional confidence to take the whole class into the computer room. Although assistance from students can compensate for a lack of teacher competence, it cannot make up for a lack of didactic concepts and imagination in integrating innovative ICT into lessons.

The hypothesis can only be affirmed if there is a guarantee that the technical ICT infrastructure exceeds a critical level.

1. **Hypothesis: Gaps in academic performance between high and low poverty students will not increase when all students have equal access to ICT. The rival hypothesis is that equal access to ICT will lead to more advantaged students increasing the performance gap with disadvantaged (high poverty) students.**

At the audited schools where there was free access to computer technology and internet and where moreover, ICT was regularly included in lessons, high poverty students had good opportunities to compensate differences to students who were able to use a computer and the internet at home. In some cases, it was observed that high-poverty students profited from the opportunity to gain ICT skills at school thus cancelling out any existing disadvantages.

The rival hypothesis was demonstrated however in the fact that students who had computer and internet access and could spend a lot of time at home training their ICT skills were at an advantage over those high poverty students who did not have these opportunities. It was reported that even when high-poverty students had been able to build up good ICT skills, they were often apprehensive in approaching ICT, teachers were convinced that this problem could not be reduced simply by free access in lessons. Low-poverty students whose parents were, as a rule, better educated and also interested in ICT received more support, which again increased the differences. The problem of self-selection often means that those who are already interested in the computer are those who tend to use the computer more in school whereby they gain skills leading to better academic performance something high-poverty students cannot necessarily achieve with in-school opportunities as they tend not to make so much use of them.

These results would tend to support the rival hypothesis.

1. **Hypothesis: Successful implementation of ICT will lead to the same or higher academic standards in spite of the low quality of many ICT materials. Academic standards are a function of teacher and school expectations and not of the standards of textbooks, ICT materials and the like. The alternative hypothesis is that ICT use will lead to a lowering of academic standards as students spend more time on marginally beneficial searches and in browsing poor quality Web and courseware content.**

In one school. it was observed that precisely such self-controlled and independent work with learning programs and a possible individualisation of learning processes led to increased academic rigour in both over-performing and under-performing students. Even some of the other schools mentioned a performance-enhancing effect in both under-performing and over-performing students. As the students work in pairs at the computer, communicative and social processes are promoted. On the whole, it is supposed that ICT can improve learning motivation in connection with independent work on subject matter. However, it remains unclear whether under-performing students profit in particular or whether over-performing students also achieve improved academic performance.

The rival hypothesis on the other hand is supported by the fact that teaching ICT skills in lessons requires more time leading to a loss of regular subject matter and that in turn leading to reduced academic standards. Searching for information in the internet is often very time-consuming as the contents are unselected and unsorted. There is a lack of serious pre-selection. Furthermore, students often neither read nor processed information found in the net and this leads again to a loss in quality of learning levels. The learning process is in danger of becoming superficial as students take over ready-made materials without really checking the contents. Easier access to information does not necessarily mean that the students keep it or process it. There is even the danger of teachers falling back on computers and internet in order to compensate for deficits in lesson preparation.

It can be assumed on the basis of the data acquired that the introduction of ICT in schools can, in some cases, lead to improved performance, although this was seldom observed and reported. It could be supposed that a continuous and further implementation of ICT in schools might possibly result in improved academic performance. At the moment, only the rival hypothesis can be affirmed.

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