OECD/CERI ICT PROGRAMME

A Case Study of ICT and School Improvement at

Agrarisch Opleidingen Centrum Oost, Twello, The Netherlands

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1. Overview

1.1 School description

The Agricultural Training Centre Oost in Twello is a school for vocational (agricultural) education. The location in Twello is one of the six locations of this school. Twello is located in the middle of The Netherlands. The income level of the parents is mixed. The other locations are found in the east of the country. The website (http://www.aoc-oost.nl/) is aimed at all six locations.

The location in Twello has a department for pre-vocational secondary education (age 12 to 16) and a department for senior secondary vocational education (age 16 to 19). These departments are closely related. They make use of the same infrastructure, but the educational programmes differ. The pre-vocational secondary education department has about 375 students. The senior secondary vocational education department has also about 375 students, of which 225 students participate in the school based learning trajectory, while 150 students participate in the dual learning trajectory (i.e., learning in a company and at school). In Twello, there are about 50 teachers.

The senior secondary vocational education department in Twello offers training for 'flower arrangement', 'animal care', 'green spaces', 'agricultural contract', 'plant growing' and 'animal husbandry'.

The training 'animal husbandry' is also offered in two other locations, namely Doetinchem and Almelo, and is a so-called level IV training (according to the Dutch qualification structure, which is based on the European system of classifications). Students can choose either of the trajectories. During four years of study, students will be trained to be manager of a cattle farm.

The Agricultural Training Centre Oost also offers courses for those who are already employed in the agricultural sector.

1.2 Educational system

Pre-vocational secondary education is part of secondary education in the Dutch educational system. After two years of 'basic secondary education' (grades 7 and 8), students can choose pre-vocational secondary education or one of the types for secondary general education. Pre-vocational secondary education (grades 9 and 10) is a new type and is a combination of pre-vocational education and junior secondary general education. At the end of the second year of basic secondary education (grade 8), the students have to choose one of the four sectors of pre-vocational secondary education: (a) engineering and technology, (b) care and welfare, (c) business, and (d) agriculture. Each sector holds a fixed combination of related subjects.

Senior secondary vocational education (grades 11 to 14, age 16 to 19) is based on the Qualification Structure. There are four levels of qualifications. These qualifications can be achieved by either the school based learning trajectory or the dual learning trajectory. Some can be achieved in either trajectory. In a school based learning trajectory, the percentage of on-the-job training varies from thirty to forty (for level IV) and in a dual learning trajectory between sixty and eighty percent (level IV). The schools for senior secondary agricultural education are called 'Agricultural Training Centres'.

1.3 School improvement and ICT

In the ICT-policy document of the school, a number of goals is summed up that have to be realised with the use of computers, like flexible teaching and learning for teacher and student, and efficiency in education. This implies that students have to be offered the possibility to learn independent of time and place. This has become necessary because of the changes in the timetable and the absence of the students during the periods in which they have on-the-job training.

Photo 1: Students doing a test with 'Perception'

The department for senior secondary vocational education has decided to offer twenty percent of the attainment targets by ICT and to reduce the contact hours with twenty percent. Teachers should use the remaining time for supervision. As soon as possible, a situation would be created in which there is one computer available for every five students. In this way ICT follows naturally from the educational innovation. ICT is seen as a prerequisite, according to the deputy principal, to realise flexible teaching and efficiency in education.

Distance learning is one of the first steps to realise this paradigm. For this purpose, the school has chosen to use the programme 'Learning Space' to create an electronic learning environment for communicating and sharing information to realise time and place independent learning. The section 'economics' has set up the subject area 'managing animal husbandry' in 'Learning Space'. The teachers have developed the materials. Students work in groups of four students. Each group collaborates with three other groups (from other locations of the school). Each group collects data at a farm and shares this information with the other groups. The groups question each other about the data. Students acquire economical knowledge, learn to collaborate, and learn to work project-centred in this environment.

1.4 Profits of improvement

The management of the school has decided that the use of ICT in education should yield a profit. This school year, the senior secondary vocational education department will get an output reduction of one percent, i.e., the budget of a department for lessons (and teachers) is reduced with one percent. This will be used for the development and support of ICT in the department. Particular developmental projects are financed by this measure. When the students are using 'Learning Space', the number of lessons by the teachers can be reduced. But at this moment, it is still difficult to achieve this goal.

According to the teacher, there are sufficient possibilities to work with the computer at school when there are no lessons. As long as the school is open, and the computer lab is not used for other activities or lessons, they are allowed to use the computers. In the timetable, they have planned lessons for this subject in the computer lab.

1.5 Accomplishments

By using 'Learning Space', the students became more flexible. They could do their assignments at moments that suited them best.

They also noticed that there were a wide variety of activities, so they had much more choices. Now, the students could do activities, which they would not have chosen otherwise. Students are working independently, but by using ICT ('Learning Space') their independence has increased. ICT makes them more actively. Their role has changed from a passive role to an active role.

Another aspect, related to the use of 'Learning Space' is that students have become more responsible for their own learning.

A teacher notices that he communicates better with his students because he is using ICT. From time to time he sends them a reminder by e-mail. When he is at school, he notices that the students have received the message. It hardly ever happens that a student says that he has not seen the message.

1.6 ICT use in the school

The school uses ICT in several ways. Students of the pre-vocational secondary education department start with a programme in which they learn the basic ICT-skills. Then they learn to use the Office programmes in relation with the subject areas, such as word-processing in Dutch and English lessons and spreadsheets in mathematics lessons. In the third year, students will do a project. The school uses 'Learning Space' as an electronic learning environment. Next year, they will introduce some new applications, which are closely related to future working environment of the students (e.g., simulations).

In most of the subject areas, the use of ICT is integrated. Geography uses an atlas on CD-ROM and gives assignments in which students have to look for information on the Internet. The Dutch language section will use a programme, which enables the teachers to develop teaching materials. The programme will take texts that are related to the training of the students from the Internet. They think that it is more useful for the students to use those texts than general texts, which do not appeal to them. The section economics uses application related to management, but also about the Euro.

The school is preparing a study planner and monitoring system. It is regarded as necessary when the school is evolving towards competence-based learning. Such a study planner must be an electronic version.

For assessment purposes, the school uses the programme 'Perception'. The school has a central database with all test items. At each location of the Agricultural Training Centre, students can have access to this database via the Internet. The teachers have to assign a test to their students. After the student has finished the test, the programme shows the result. At school, but also at home, students can do a trial test.

Because it is a school for vocational training, there are many programmes available, which also used in the agricultural sector.

'Learning Space' is used in two subject areas 'managing cattle arm' and 'economics/trade'. In 'managing animal husbandry', students collaborate with groups of students of Doetinchem and Almelo. This electronic learning environment is well suited for communication between students among themselves and between students and the teacher.

In general, ICT has become fully accepted. Students use the computer to prepare their reports, they do not submit hand-written reports anymore. Some teachers require computer-written reports.

1.7 Primary innovations

There is a long tradition of innovations in education and applying projects in the school. It is step by step approach, in which the step to the next developments is not that large. In 1995, the school has started to implement problem based education.

The school has made the transition from supply-controlled to demand-controlled learning. For the teachers it is difficult to make this transition. They need to change their teaching approach. A gradual change appeared to be better.

At this moment, the focus in the school is on competence-based education. When the students have to do a test, they collect all knowledge they need to know for that particular test. The school realised that knowledge was not sufficient to train good managers. Students need more skills to be a manager. These skills have to be evaluated too. The educational programme has been adapted: students have to make their planning, they will be supervised, and there will be sessions and evaluations. The school uses a range of evaluation methods, varying in the degree of authenticity and in the intensity of the procedure, from 'collecting document in a portfolio' to 'authentic assessment'.

According to one of the teachers, competencies and key qualifications are the new 'buzz'-words. The problem is to watch the balance between skills and knowledge, but also to watch to skills itself.

Recently, the school started with KS2000 (Qualification Structure 2000) with a small group of teachers as a kind of pilot-project. These teachers will develop the concepts and transfer them to their colleagues at the various locations. KS2000 is, according to the technology co-ordinator, more than competence and assessment. KS2000 will make a change to products, but not an assignment and a load of information that will be linked together, it will be the 'complete learning'.

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2. The Past

2.1 Innovation history

In 1987, the location in Twello started to use the computers for the secondary process (management, preparation of lessons, etceteras). From 1995, computers have been used for the primary process. Students could make use of the Internet and e-mail. About one year later, the school collaborated with a Regional Training Centre (also a school for senior secondary vocational education) to experiment with distance education. A teacher of the Regional Training Centre offered lessons to the students of the Agricultural Training Centre. However, the technology did not function well. This had a negative impact on the experiences, but the students were motivated to participate and were positive about the experiment.

The positive reactions of the students encouraged the school to continue. The school became one of the 'Vanguard schools'. With the funding, the school could set up an ICT-infrastructure.

About three years ago, the school has chosen a programme to develop an electronic learning environment, with which the school wants to realise time and place independent learning. 'Learning Space' was chosen because of the possibility to communicate with each other. The economics teachers first used the programme for two reasons: (a) they had a lot of experience with computers, and (b) economics is part of each training. The first electronic learning environment was 'managing animal husbandry'. The idea was that when they have developed an electronic learning environment for one course, it could be transferred easily to the other courses. However, it appeared to be more complicated than was expected.

2.2 Initiator of the innovation

The respondents agree that the deputy principal initiated many of the ICT-activities and -projects in the school. The deputy principal is involved in the educational innovation of the whole Agricultural Training Centre. ICT is included in his tasks. He is one of the authors of the ICT-policy document of the Agricultural Training Centre. In this document, he has paid attention to the sections about education. The three main topics in this document were: communication, administration and education. These topics have been elaborated in five points meriting attention: administration, network management, educational projects, educational support and communication.

The technology co-ordinator illustrates the initiator of the innovation as follows. "If you want a project to be successful, you need a man, a story and a disaster. The man is the deputy principal, the story is the need to change of the educational approach to survive, the story is also the disaster, we are standing with our backs against the wall, it is sink or swim." The school has to be innovative to be able to continue.

2.3 Supporters of the innovation

For ICT in general, the school has several persons who support the use of ICT. First, the Board of Governors, which has to agree with the ICT-policy of the school. When the school became a 'Vanguard school', the board had to take the appropriate actions.

At the location in Twello, there is a educational director. He supports the ICT-projects and the innovation projects in the school. Together with other persons in the school, he developed teaching-learning situations for the students.

The technology co-ordinator stimulates the teachers to use teaching materials for their subject areas in which ICT is integrated. The technology co-ordinator is also the system- and network manager. Therefore, teachers can ask him educational as well as technical questions.

More specific to 'Learning Space', the teachers who were involved, were enthusiastic and motivated. The deputy principal supported their activities by their participation in a course to learn more about 'Learning Space'.

2.4 Innovation problems

'Learning Space' as wells as 'Perception' make use of the Internet. One of the main problems is unreliability of the connection with the Internet. The connection is established via Kennisnet (a national computer network for schools and related organisations, which gives the schools access to the Internet). The school has three ISDN-connections, though a wide-band connection of two Megabytes has been promised.

When there is no connection, which happens quite often, teachers have to change their lessons. That is not stimulating for the teachers, or for the students. Students who are doing a test with 'Perception' become frustrated when the connection is broken. The answers, they have given so far, are lost. They have to do the test again.

The technical problems have a negative impact on the development of the electronic learning environment and solving the problems related with this environment: What about the teaching aspects? What about the supervision? What about feedback?) A teacher notices that working in a group is in conflict with the concept of time- and place-independent learning. Students have to

make arrangements when and where they meet. Students, who do not have a computer at home or no access to the Internet, have to do their assignments at school.

Photo 2: The computer lab of the school

The technical support is not regarded as sufficient. The system manager works also at another location. The school has about ninety computers and a network. Therefore, the system manager should be full-time at this location.

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3. The Present

3.1 Diffusion patterns

The initiator of the (ICT-) innovations, the deputy principal, asks the teachers of whom he thinks will be enthusiastic to participate in a project in which ICT is used. He supplies them with the materials. The teachers have to develop it in such a way that the other teachers will accept it. With these ICT-projects the school hopes that the teachers who already use ICT and have learned about ICT by carrying out these projects, will take the other teachers whom do not use ICT in tow. It should be like an inkblot. Within the framework of KS2000, a pilot-project was started with a small group of teachers. They have to do the developments and diffuse the results to their colleagues.

Teachers of the economics section used 'Learning Space'. They have a lot of experience with ICT in economics. In the three locations that offer 'animal husbandry', there were two teachers who knew a lot about 'Learning Space' were able to go, together with two colleagues, to a course on 'Learning Space' to learn more about the principles of the programme.

The teachers of senior secondary vocational education who were not involved in the ICT-projects, became involved in the innovation of education and were kept informed about the current projects. However, the enthusiasm of the teachers of senior secondary vocational education who participated in an ICT-project was not transferred to the teachers of pre-vocational secondary education. The gap between these two groups of teachers appeared to be too large.

3.2 Staff development and involvement

It is the policy in all locations of the Agricultural Training Centre that all teachers have to achieve the European Computer Driving Licence (ECDL). It required a great deal of effort to persuade all teachers, especially the teachers of over fifty years of age, who

have never touched a computer before. All teachers have received an ECDL-card and the progress will be discussed individually with the management. Half of their study time (eighty hours in a year) has to be spent on the ECDL. Teachers have three years to achieve the European Computer Driving Licence. Some teachers have already achieved this Licence.

The teachers who were asked to use 'Learning Space', were given the possibility to go to an external course. A teacher told us that he has been at an information session. The presenter knew a little bit more than they knew about the programme. The teacher wants to know more and thinks that he is not using all possibilities of the programme. He also said that it is problematic when you are one of the firsts to use it: others think that you are an expert.

The school organises meetings in which the teachers are able to present their experiences with the use of the computer in their teaching or to show how they use the computer. These meetings are intended to inform and to show other teachers the possibilities of ICT. The aim of the meetings is to make them enthusiastic too. An internal course is not considered yet.

Nearly all teachers have participated in a 'private PC' project, in combination with a connection to the Internet. Many of the teachers have discovered in this way the Internet and e-mail, and use them in their lessons too.

3.3 Role of leadership

The deputy principal of the location in Twello is the manager of the department for senior secondary vocational education. For two days a week he is responsible for this task. The other days of the week he is engaged in the innovation of the educational process of the Agricultural Training Centre. ICT is included in this innovation.

He regards himself as a promoter of ICT. He sets up and manages various ICT-projects in the school. To carry out these projects he looks for those teachers who have experience with ICT (in education) and who are enthusiastic to develop new applications and materials in which ICT is integrated. He admits that this approach is not always successful. For a specific project he had a group of teachers who did very well, but these teachers could not motivate and stimulate other teachers. The distance between these two groups was too large.

3.4 ICT-innovation Connections

The Agricultural Training Centre has five locations. Each of them is too small to start innovations and/or developments. Collaboration with other locations creates possibilities to develop parts of the curriculum together. The module 'animal husbandry' is an example of the collaboration of the teachers from three locations (Twello, Doetinchem and Almelo), which have this training in senior secondary vocational education. The teachers who are involved in this module meet each other frequently.

Photo 3: Students at work in the Information centre

The school has also connections with other Agricultural Training Centres in The Netherlands. One of these institutes has asked

whether it is possible that a number of their students participate in a module of Agricultural Training Centre Oost. The students can log on to the electronic learning environment that has been created for that particular module. Now, it is in an initial stage. The school expects that this will happen in the future more often.

3.5 ICT infrastructure

The school has about fifty computers for students, including twenty multimedia computers (equipped with a CD-ROM and a sound card). For educational use a video-projector, a scanner, a laser printer and a colour printer are available.

A great number of these computers are available in the computer lab. The computer lab (twenty-two computers) can split up in two or three smaller rooms by means of sliding walls. Two small groups can use the facilities at the same time. Printing facilities are available in the computer lab.

Students can work in the Information centre of the school. Fifteen computers, all connected to the Internet, are available in this centre. A scanner and a laser printer are available for the students. The computers are always occupied. Soon, some extra computers will be installed in the Information centre.

The school is connected to Kennisnet, which gives access to the Internet. In all classrooms a connection to the Internet is available. Half of the computer is connected to the Internet.

The school has a wide variety of software available. Besides the Office-programmes, there are many applications and programmes, which are also used in practice, at farms, nurseries and garden centres.

The system manager is working at several locations. The location in Twello has also an assistant system manager. The present technical support is not regarded as sufficient (it is a matter of money).

3.6 Effectiveness

The teachers think when they use the computer for educational purposes, their role changes from passing on knowledge to supervising of students. In spite of the problems with the network and Internet, the teachers are still motivated to develop modules in which ICT is integrated. The teacher we have spoken with told us that he is communicating more frequently with his students He sends them notes or reminders by e-mail.

The role of the students has also changed by using ICT. Students are working more actively when they use the computer. In addition, it appeals to their independence and responsibility. As a result of the use of 'Learning Space' in 'managing animal husbandry', students are working more independently than before.

At this moment, the school has not reached yet the goal to reduce the number of lessons since 'Learning Space' has been implemented. The use of ICT in education should yield a profit.

The teacher who developed the electronic learning environment for 'managing animal husbandry', is still not convinced of the usefulness of 'Learning Space' because of the technical problems. Sometimes, he considers using a book and having the students send the assignments by e-mail only. But these assignments have to be marked. He did it in an electronic way: opened the file with the assignments in Word, students typed their text in black and he typed his remarks in red. It cost a lot of time. Other teachers gave a mark only. But the teacher regards this as a decline: students get less feedback than in the old situation. Electronic feedback costs more time.

3.7 Academic rigour

Two ICT-projects have been set up in which 'Learning Space' is used to create an electronic learning environment. This concerns 'managing animal husbandry' and 'economics/trade'. The electronic learning environment has clear structure to design and develop education. It also contains the possibility for communication between students among themselves and between students and the teacher.

The use of ICT brings about changes in many aspects and the danger is that teachers think that they are doing it in a new way, but in fact it was the old way. There was a complaint that students did not have the same knowledge anymore as before. But it was forgotten that it was a different teaching/learning process that also needs monitoring and supervision by the teacher. The control process was completely forgotten. Also because students were acquiring new skills and competencies. Teachers have to be familiar with the programme and know all characteristics of it. It is a drawback of every 'Vanguard school', everything is new and experience is lacking. According to the technology co-ordinator, education can only be improved by using ICT if all subject matter is reviewed fully and critically.

3.8 Equity

The deputy principal as well as the teacher we have spoken with has noticed that the electronic learning environment appeals more to the girls than to the boys in their school. It looks like girls are able to work more independently than boys are at that age. It is also known that girls learn differently. Girls are working is a more structured way and are more serious than boys. Boys show a different behaviour: they want to be popular and are busy doing other things in their environment. Boys make more noise than girls do.

Not all students have a computer at home. They have to use the computers at school. But when all computers, e.g., in the Information centre, are occupied, they complain.

Some of the students have indicated that they are not interested in the computer. But many boys like it very much. There are quite a lot of girls in his class, according to the teacher, seven out of twenty-one. These girls are rather fanatic when it comes to using the computer.

The weaker students, who also have to work independently, will have a hard time. Then, they have to depend on the members of their groups. A teacher has little influence on this. According to the teacher, these students may be the victims of this system. Other systems have their disadvantages too.

3.9 Sustainability

The choice to offer twenty percent of the attainment targets by using ICT and to reduce the contact hours with twenty percent implies that the school wants to use ICT to replace the traditional teaching and wants to fit ICT in to realise an innovation of the teaching/learning process. The use of programmes like 'Learning Space' and 'Perception' is meant to implement this innovation. The technical problems impede the innovation. Teachers have to find solutions when the system fails, e.g., use their books (some students think that they can learn something at last). The teachers have less time to learn more about the programmes and apply the possibilities of the programmes.

3.10 Scalability

If other schools for senior secondary vocational education want to implement this innovation, they need a good ICT-infrastructure: enough computers and a functioning network. You also need members of the staff who know a little about computers and you have to teach the students the basic ICT-skills.

It is also necessary that the Board of Governors supports the innovation and is willing to invest money. When you have done the first step, the second step has to be taken. If someone blocks this step, you cannot continue.

The pedagogical practice paradigm has to be adapted. Teachers need to collaborate with each other and work together. Also students have to learn this.

With 'Learning Space' the teachers have to give a new interpretation of their subject. School will start the discussion: what do we want to do with the programme (while nobody knows what can be done), while others will say that is not important. While you work you discover the possibilities of the programme. It cannot be prevented, all schools will have this discussion, according to the teacher.

3.11 Results of the Teachers ICT Practices Survey

The Teachers ICT Practices Survey was given to five teachers of the economics section. Four surveys were returned. The tables with the results are presented in Appendix A.

The teachers feel (very) comfortable with using a computer to write a paper, to search for information on the World Wide Web or to send and receive e-mail. They feel (somewhat) comfortable when they use a database or when present information (with PowerPoint). They do not feel comfortable with the computer to create and maintain web pages or to use a programming language.

In the past school year their students did use the World Wide Web, send or receive e-mail, use a word-processing programme several times each month or week. Their students did not use a computer to play games or use a presentation programme. A spreadsheet, a graphics programme and an instructional programme were used a few times. An on line forum or chat room was joined also a few times.

Three quarters of the teachers rate their ability to use a computer as 'fair', one quarter as 'good'.

In the last school year, student computer use was evaluated for grading according to all four teachers. One teacher created or modified a web site with any of his classes. All computer use in their classes was directly related to the course content. Some of the computer use that the teachers assigned was done by students individually according to three teachers (one teacher says most of the

computer use).

The teachers do not impose restrictions to the students when they assign World Wide Web searching.

The degree in which the teachers use a computer at home for preparing for lessons, varies from 'a few times' (one teacher) to 'several times each week' (two teachers). Two of the teachers have participated as a student or instructor in a virtual course through the Internet. Three of four teachers have involved their students in collaborative learning over the Internet.

Three teachers use technology to collaborate with other teachers. Three teachers send each day on average one of five e-mails (one teacher more then twelve).

(Nearly) all have not made changes to a computer's hardware or created a web site. Three teachers have updated an application program, recovered a damaged file and/or developed a database.

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4. Main hypotheses

4.1 Technology is a strong catalyst for educational innovation and improvement

The ICT-policy document of the school makes clear that ICT will have an important function in the teaching/learning process: a part of the attainment targets will be offered by ICT (see section 1.1). ICT is used to realise flexible teaching and efficiency in education. By applying the programmes 'Learning Space' and 'Perception' the school wants to realise this goal. Distance learning, independent working by students, collaboration between groups of students of various locations and communication between teachers and students make use of ICT (see section 1.1 and 1.3). ICT can be regarded as a catalyst in this school.

Photo 4: This part of the computer lab can be used separately

The deputy principal of the school is very active in the field of ICT. He initiates several ICT-projects, with which he innovates the senior secondary vocational education in the school (see section 2.2 and 3.3).

However, the problems with Kennisnet, which gives access to the Internet impede the developments (see section 2.4). Next, the expected reduction of lessons has not yet taken place (see section 1.2).

On the basis of these findings, the hypothesis can be accepted. ICT has a strong influence on the innovation in this school.

4.2 The diffusion followed the traditional diffusion pattern for innovations

When the school starts to implement an innovation, the same approach is chosen. The deputy principal asks teachers who will be enthusiastic and have sufficient experience with ICT for an ICT-project. This group of teachers implements the innovation. The members of the ICT-projects develop materials and have to prepare the implementation in the school (makes it acceptable for the other teachers). During the ICT-projects, the other teachers are informed about the projects (see section 3.1).

For the implementation of KS2000, the school has set up a pilot-project. A small group of teachers is involved, but in the end, all teachers will apply this innovation (see section 3.1).

The school has two departments, one for pre-vocational secondary education and one for senior secondary vocational education. Implementation and diffusion of innovations in senior secondary vocational education are not transferred to pre-vocational secondary education because of the gap between the two groups of teachers (see section 3.1 and 3.3).

The hypothesis regarding the traditional diffusion pattern cannot be rejected. An innovation with ICT is regarded just as any innovation: implementation starts with a small group of enthusiastic teachers.

4.3 Successful implementation of ICT depends mostly upon staff competence

'Learning Space' was implemented in the training 'animal husbandry', and in particular in the subject area 'managing animal husbandry'. This training and subject area were chosen because the teachers who are involved (teachers of the economics section) use ICT in several ways (spreadsheet and various applications which are related to the practice) (see section 2.1). They were able to attend a course about 'Learning Space' (see section 2.3).

All teachers have to achieve the European Computer Driving Licence. Some teachers already have achieved this Licence. Nearly all teachers have participated in a 'private PC' project (see section 3.2).

Though the teachers are ICT competence and the teachers involved have attended an external course, not all aspects of 'Learning Space' are known. Compared with other schools, this school has relatively a lot of experience with the programme. In general, there is little experience. One of the teachers thinks that does not master the programme completely. The other teachers have been informed about 'Learning Space'. An internal is not yet an issue (see section 3.2).

More important are the technical problems with the Internet. At irregular moments the connection with the Internet is broken. The school has access to the Internet via Kennisnet. The school was promised a wide-band connection, but until this moment, this has not been realised yet (see section 2.4).

In spite of these technical problems, the hypothesis can be accepted. The school uses of 'Learning Space' in several ways and will also create an electronic learning environment in pre-vocational secondary education.

4.4 Gaps in academic performance between high and low poverty students will not increase

Most of the students of senior secondary vocational education have a computer at home. But at school, there are sufficient possibilities for those who do not have a computer at home, to use a computer (see section 2.4). All students can go the Information centre of the school. Sometimes, the students who are dependent on these computers complain that all computers are occupied (see section 3.8). The number of computers will be expanded (see section 3.5).

For the students of the subject area 'managing animal husbandry', the school has planned lessons in the computer lab for them which can be used to do their assignments (see section 1.2). Also at other moments, when the computer lab is not in use, students can work there.

There is not sufficient evidence to reject the hypothesis. The performance gap will not increase because of the possible limited access to ICT.

4.5 Successful implementation of ICT will lead to the same or higher academic standards

The curriculum of the school is based on competence-based education. For students who are trained to become manager (level IV of the qualification structure), knowledge is not enough. Competencies are also required. The curriculum has been adapted, though it can be problematic to find a balance between knowledge and competencies (see section 1.6).

The implementation of 'Learning Space' brings about a different pedagogical practice paradigm, which is based on competencies and less on knowledge. In the subject area 'managing animal husbandry' students learn other, additional skills like communication and collaboration (see section 3.7). In this way, this subject contributes to competence-based education.

It cannot be concluded that the implementation of ICT has lead to lower academic standards as before. Therefore, the hypothesis

can be accepted.

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5. Projection to the future

5.1 Sustainability

The ICT-policy document describes how ICT will be integrated in the teaching/learning process of the school. ICT in the school has to be effective, efficient and liveable, has to prepare students for the society and has to prepare students for the world of employment. ICT is used to offer twenty percent of the attainment targets.

The training 'animal husbandry' is focussing on electronic learning environments with 'Learning Space. We have not received signals that the management of the school is considering to end this particular innovation in due time.

The ICT-infrastructure will improve, according to the ICT-policy document. One of the aims is that in 2002 the student : computer ratio will be five to one (one computer for every five students).

ICT as an innovation is strengthened by setting up working groups, which are cross-curricular and go beyond locations.

5.2 Scalability

A distinction regarding scalability can be made between within the Agricultural Training Centre and other schools for secondary vocational and general education.

Firstly, within the school. Economics will be the spearhead because it is an element in all training in senior secondary vocational education. Experiences and results can be transferred easily to other sections.

Next to 'managing animal husbandry' an electronic learning environment has been developed for 'economics/trade' (both in senior secondary vocational education). For pre-vocational secondary education also an electronic learning environment, based on 'Learning Space', will be developed, which will be used for an assignment for biology which the students get in the third year of their study. Students of the middle-management vocational pathway have to make an integrative assignment. The school wants to use 'Learning Space' for this purpose too.

Other schools can benefit from the experiences with 'Learning Space' next to the essential requirements as a budget for computers and network (ICT-infrastructure) and staff development, support form the management and a reflection on the present pedagogical practice paradigm. A group of enthusiastic teachers develop and implement the electronic learning environment.

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Appendix A: Tables for Teacher ICT Practices Survey

Gender of the respondents

		Count	Col %
Gender teacher	female	0	,0%
	male	4	100,0%
	not answered	0	,0%
Group Total		0	100,0%

How comfortable are you with using a computer to do each of the following?

	Create and maintain web pages		Write a paper		Search for information on the World Wide Web	
	Count	%	Count	%	Count	%
not at all comfortable	3	100,0%	0	,0%	0	,0%
somewhat comfortable	0	,0%	0	,0%	0	,0%
comfortable	0	,0%	0	,0%	3	75,0%
very comfortable	0	,0%	4	100,0%	1	25,0%

Total	3	100,0%	4	100,0%	4	100,0%

How comfortable are you with using a computer to do each of the following? (continued)

	Use a data base		Send and receive e-mail		Programming (i.e., use a programming language)	
	Count	%	Count	%	Count	%
not at all comfortable	0	,0%	0	,0%	3	100,0%
somewhat comfortable	3	75,0%	0	,0%	0	,0%
comfortable	0	,0%	2	50,0%	0	,0%
very comfortable	2	25,0%	2	50,0%	0	,0%
Total	4	100,0%	4	100,0%	3	100,0%

How comfortable are you with using a computer to do each of the following? (continued)

	Draw a picture or diagram		Present information (e.g., use PowerPoint)	
	Count	%	Count	%
not at all comfortable	1	25,0%	0	,0%
somewhat comfortable	0	,0%	2	50,0%
comfortable	3	75,0%	2	50,0%
very comfortable	0	,0%	0	,0%
Total	4	100,0%	4	100,0%

During the past school year, how often did your students on average do the following?

	Use the World Wide Web		Create web pages		Send or receive e-mail	
	Count	%	Count	%	Count	%
never	0	,0%	3	75,0%	0	,0%
a few times	0	,0%	1	25,0%	0	,0%
several times each month	2	50,0%	0	,0%	2	50,0%
several times each week	2	50,0%	0	,0%	2	50,0%
Total	4	100,0%	4	100,0%	4	100,0%

During the past school year, how often did your students on average do the following? (continued)

	Use a word processing program		Use a computer to play games		Use a spreadsheet	
	Count	%	Count	%	Count	%
never	0	,0%	4	100,0%	0	,0%
a few times	0	,0%	0	,0%	3	75,0%
several times each month	0	,0%	0	,0%	0	,0%
several times each week	4	100,0%	0	,0%	1	25,0%
Total	4	100,0%	4	100,0%	4	100,0%

During the past school year, how often did your students on average do the following? (continued)

	Use a graphics program		Join in an on-line forum or chat room		Use a presentation program (e.g., PowerPoint)	
	Count	%	Count	%	Count	%
never	2	50,0%	1	25,0%	3	75,0%
a few times	1	25,0%	2	50,0%	0	,0%
several times each month	0	,0%	1	25,0%	1	25,0%
several times each week	1	25,0%	0	,0%	0	,0%
Total	4	100,0%	4	100,0%	4	100,0%

During the past school year, how often did your students on average do the following? (continued)

	Use an instructional program (including simulations)		Other computer uses	
	Count	%	Count	%
never	0	,0%	1	100,0%
a few times	3	75,0%	0	,0%
several times each month	0	,0%	0	,0%
several times each week	1	25,0%	0	,0%
Total	4	100,0%	1	100,0%

Rating the ability to use a computer

		Count	Col %
	poor	0	,0%
How would you rate your ability to use a computer?	fair	3	75,0%
	good	1	25,0%
Group Total		4	100,0%

Based on experiences or polices from the last school year

	Was student computer use ever evaluated for grading?		Did you create or modify a Web site with any of your classes you taught?	
	Count	%	Count	%
no	0	,0%	3	75,0%
yes	4	100,0%	1	25,0%
Total	4	100,0%	4	100,0%

Based on experiences or polices from the last school year (continued)

	What portion of the computer use in your classes was directly related to the course content?		What portion of the computer use that you assigned was done by students individually?	
	Count	%	Count	%
very little	0	,0%	0	,0%

some	0	,0%	3	75,0%
most	0	,0%	1	25,0%
all	4	100,0%	0	,0%
Total	4	100,0%	4	100,0%

Based on experiences or polices from the last school year (continued)

	If you assigned World Wide Web searching, how much freedom did you allow?	
	Count	%
designated sites only	0	,0%
some restrictions	0	,0%
no restrictions	4	100,0%
Total	4	100,0%

Based on experiences or polices from the last school year (continued)

	How often did you use a computer at home for preparing for teaching?	
	Count	%
never	0	,0%
a few times	1	25,0%
several times each month	1	25,0%
several times each week	2	50,0%
Total	4	100,0%

Based on experiences or polices from the last school year (continued)

	Did you participate as a student or instructor in a virtual course through the Internet?		Did you involve your students in collaborative learning over the Internet?	
	Count	%	Count	%
no	2	50,0%	1	25,0%
yes	2	50,0%	3	75,0%
Total	4	100,0%	4	100,0%

Using technology to collaborate

		Count	Col %
Are you using technology to collaborate with other teachers?	no	1	25,0%
	yes	3	75,0%
Group Total		4	100,0%

Sending e-mails each day on average

		Count	Col %
	none	0	,0%
How many e-mail messages total do you send each day on average?	1-5	3	75,0%
	6-11	0	,0%
	more than 12	1	25,0%
Group Total		4	100,0%

Have you ever done the following?

	Made changes to a computer's hardware		Updated an application program (word processor, graphics program)		Recovered a damaged file	
	Count	%	Count	%	Count	%
no	4	100,0%	1	25,0%	1	25,0%
yes	0	,0%	3	75,0%	3	75,0%
Total	4	100,0%	4	100,0%	4	100,0%

Have you ever done the following? (continued)

	Created a web site		Developed a data base	
	Count	%	Count	%
no	3	75,0%	1	25,0%
yes	1	25,0%	3	75,0%
Total	4	100,0%	4	100,0%

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Appendix B: Other supporting evidence

- At the location in Twello, there are 50 computers available for 750 students (student : computer ratio = 15.0).
- All computers are connected to the Internet.
- Computers for students are available in the computer lab and in the Information centre.

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Appendix C: Documents

- AOC Oost, (1999), ICT Een Hoge Vlucht (ICT-policy document), Almelo.
- AOC Oost, (1999), AOC Oost, dát leeft! Kenniscentrum voor voeding, natuur en milieu. Strategisch Beleidsplan 1999-2003 (Strategic Policy Document), Almelo.
- AOC Oost, (2000), De MBO-Opleidingsgids van AOC Oost. Schooljaar 2001-2002 (Information brochure Senior Secondary Vocational Education).
- AOC Oost, (2000), Overzicht MBO-opleidingen (Overview of Senior Secondary Vocational Training).
- AOC Oost - Twello, (2000), Studiegids 2000-2001 (Study Guide): Department Senior Secondary Vocational Education, School based learning trajectory.
- AOC Oost - Twello, (2000), Studiegids 2000-2001 (Study Guide): Department Senior Secondary Vocational Education, Dual learning trajectory.
- Janssen Reinen, I. & Slotman, K., (2000), Het einde bereikt en een begin gemaakt. Verslag van de eindrapportages van de

landbouw-voorhoedetrajecten (Reports of the Vanguard trajectories in Agriculture), Enschede.

- Website AOC Oost: http://www.aoc-oost.nl/.
- Assessment diagram (degree of authenticity vs. intensity of the procedure).
- Assessment form Group Work.
- ICT-organisation at AOC Oost, location Twello.

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