Becta
ICT Research

Project 3: evaluation of the Intel Play QX3 Microscope

The Science Team of the Division of Pre- and School Learning at the University of Northumbria conducted the research on which this summary is based.

Introduction

As part of Science Year[1], a free Intel® Play™ QX3™ Computer Microscope[2] was given to all maintained primary and secondary schools in England. The digital microscope is an easy to use, high-tech instrument that connects directly to a computer and allows pupils to capture magnified images, record live video or make time-lapse movies of the objects under the lens. Pupils can then add special effects, drawings, paintings, and text, and save and print their work.

This small-scale investigation focused on the use of the computer microscope in 12 primary schools geographically convenient to Northumbria University. The aims of the project were to:

- evaluate the use of the microscope in the classroom
- observe and record the use of the microscope in science across Key Stages 1 and 2 and also in the Foundation Stage
- develop a cluster of 'project schools' (with teachers with varying levels of competency in ICT) to develop activities for the microscope in science and other curriculum areas
- develop web-based material to train teachers in the use of the microscope and its potential
- develop web-based material to support the progressive development of the use of the microscope in the classroom and across key stages (and Foundation Stage), including case studies to exemplify effective and innovative use
- examine the extent to which joint planning affected the teaching and learning that took place with the microscope.

In addition to evaluating the use of the microscope and developing web-based materials to support its use, the project set out to explore the impact of shared lesson planning on the use of ICT in the primary classroom. In particular, the impact of collaborative, medium-term planning on the classroom use of the microscope. However, due to the relatively short timescale, the project focused mainly on evaluating the use and impact of the equipment in the participating schools.

When primary schools were given the microscope, few realised that they were due to receive it. Consequently, many schools failed to make their staff aware of its existence and this had an effect on its initial use. Thus, although 10 of the 12 schools reported that the microscope had been taken out of its packaging, its use before the start of the project appears to have been limited to a minority of staff - often a single person in each of the project schools. Similarly, the range of use also appeared limited. Therefore, because many of the teachers started using it only

[1] Science Year (September 2001 to August 2002) was part of the Government's campaign to improve the teaching of science across primary and secondary education.

[2] In March 2002, Intel discontinued manufacture of this microscope preferring to concentrate on its core business. Prime Entertainment bought the assets of the Intel toy line and now sells the microscope under the Digital Blue business brand [http://playdigitalblue.com/home].

after being told about this project, the data presented tends to over-report the use of the microscope.

While the project focused on the science curriculum as the main area of application for the computer microscope, its use in other curriculum areas was also explored, for example, in subjects such as English and art. Teachers in project schools were asked to use the computer microscope with a range of year groups. This was to enable data collection regarding the development of progressive use of the microscope across the primary years, from nursery to the end of Key Stage 2.

Although the main audience for the proposed web-based materials would be teachers, it was felt that the materials should be made useful for others providing support in the classroom. For example, Specialist Teacher Assistants, Learning Support Teachers and even parents could be trained to support the use of the microscope.

Methodology

The research team set out to evaluate the use of the microscope in the classroom using a range of data collection techniques including questionnaires, and interviews and observations with teachers, children and other significant adults in the classroom, including parents. Participant and non-participant observation enabled the researchers, who were aware of the full potential of the Intel Microscope, to work with children and teachers to challenge the boundaries that the teachers perceived when using this equipment.

Each of the 12 schools invited to join the project nominated a member of staff to attend an initial meeting on the development of the project and the use of the computer microscope. Each school was given an additional microscope and a choice of either a digital still or digital video camera with which to record evidence for the project. At all stages of the project at least one member of staff from each school was involved, and in some schools several members of staff worked together.

The participating teachers worked with a range of children from nursery through to Year 6, usually in their own class and mainly as part of science lessons. However some teachers worked with other classes and in one school the teacher worked with children taking part in an after school science club. Throughout the project the aim was to ensure that the digital microscope was used in everyday, realistic school settings, as part of the normal school routine.

Data collection

One teacher from each of the schools completed the initial questionnaire. The questionnaire covered:

- use of the microscope in the school
- teacher competency and attitudes in science related to use of ICT
- the usefulness or otherwise of web-based training materials
- the nature of any web-based training materials
- use of ICT in science and across the curriculum.

In addition, a range of evidence was requested and teachers were asked to keep:

- a personal log of their own professional development using the microscope
- digital photographs and/or video material of the use of the microscope in a range of contexts and curriculum areas
- records of activity plans where the microscope was used

- evidence of children's work as a result of using the microscope
- notes on key issues arising from the use of the microscope.

Discussions were held with both teachers and children to find out the following:

- how they used the microscope
- advantages and disadvantages
- preferences
- initial reactions to the Intel Play QX3 Computer Microscope.

This data would provide the basis for developing in-service training material to illustrate the scope and the potential of the microscope to support primary science and other curriculum subjects. Evidence also highlights how teachers and children used the microscope, their learning styles, and issues related to the computer microscope's use. The data would also provide evidence on which to base recommendations for further research and curriculum development projects.

Overview of the participating schools

Location – the research was carried out in schools in local education authorities in Northumbria. (All project schools were involved in the initial teacher training (ITT) programme of Northumbria University.)

Pupil age range – the sample covered first, primary and middle schools across the whole primary age range from nursery to Year 6. It was made up of:

- one middle school (Years 5 to 8)
- three first schools (Reception – Year 4)
- eight primary schools (Reception –Year 6).

Socio-economic factors – the sample included schools in both advantaged and disadvantaged areas. More than half the schools were located in areas of high unemployment and/or had significant numbers of pupils from ethnic minority groups. One school was successfully emerging from Special Measures.

School roll and staffing levels – the size of the schools varied, with the largest school having 480 pupils and 18 staff, and the smallest having 160 pupils and 8 staff.

General ICT provision – all schools had received the computer microscope although one school's microscope had been stolen. One school had acquired two additional microscopes. All 12 schools had digital cameras and five had video cameras.

Role of schools' lead project person – there were 9 science co-ordinators plus one maths teacher, one ICT teacher, and an assistant head. A newly qualified teacher also took part.

Teacher ICT competency – the teachers involved reported competency levels ranging from 'less confident' to 'expert'.

Use of ICT in science before the project – ICT was not widely used by project teachers in the key curriculum areas of sensing and data handling, despite being a statutory requirement.

Key findings

This was a small-scale study involving only 12 schools and therefore findings cannot be generalised and any inferences made from the data collected must be treated accordingly. While there may be issues associated with applying the findings of this study to all primary schools, many of the themes emerging may be of value and interest to other schools.

Learning styles

It became clear during discussions that the preferred learning style for finding out how the digital microscope worked was the same for both teachers and children. Both groups engaged in a period of exploration or ‘play’ without consulting the instruction booklet, other than to find out how to switch on the microscope and load the software.

Because many teachers felt they had insufficient time to learn to use the microscope in school, they took it home to explore at their leisure. Regardless of where teachers chose to explore the microscope, the pattern of learning was the same. They:

- took the microscope out of the box
- found out how to load the software
- ‘played’ with the microscope
- tried the different facilities
- sometimes referred to the instruction booklet.

Teachers commented that the first thing they viewed with the microscope were their own body parts – hair, skin, eyes, and so on. Further discussions revealed that children followed almost exactly the same process, including choosing to view their own body parts.

Motivation

The study revealed the power of the computer microscope to motivate children working in science. All teachers commented that when pupils used the digital microscope they became highly motivated, and pupils’ comments supported this observation.

Many pupils became highly skilled at using the microscope. They were keen to explore all of its features and to teach other children its use. Their enthusiasm was important in encouraging teachers to use the microscope more often and for a wider range of tasks than originally planned. Frequently the children suggested how it, or one of its numerous features, could be used in a particular situation. The children had the confidence to explore the microscope’s potential and often carried the teacher along with them.

Children as experts

During discussions with children it became obvious that they soon became the ‘experts’ in the classroom. Teachers encouraged this role by asking children to:

- teach other children how to use the microscope
- be the ‘monitor’ for setting up the microscope
- teach other adults working in the classroom, for example, classroom assistants
- set up the microscope to be used with a whiteboard
- carry out specific tasks using the microscope.

Children quickly recognised some of the inherent difficulties in using the microscope. The most frequently reported difficulty was ‘getting the focus just right’. In particular, most users found the 200X magnification problematic. Some children also reported that they found difficulty in recording movies. However, children acknowledged these difficulties as challenges and continued to work with the microscope.

During the course of the project there was a notable increase in the confidence with which both teachers and children used the microscope. This confidence was not restricted to users in science. A significant number of teachers and children working in other subject areas became proficient users as they explored the potential of the digital microscope.

Support for teaching science

All teachers found that the microscope offered excellent support for teaching science. It was used to:

- motivate and interest children
- develop scientific concepts
- support children in making predictions and hypotheses
- develop observation
- provide the stimulus for ‘fair test’ investigations
- show change over time
- develop discussion and argumentation in science.

The microscope gave pupils the opportunity to view everyday objects from a very different perspective. This was one of the most important benefits as it allowed pupils to make sense of complex ideas in science, for example, paper towels and absorbency. It also gave children access to views of objects where the ‘ordinary was made strange’.

Support for other areas of the curriculum

In all project schools teachers found that the microscope had the potential to support other areas of the curriculum. For example, the microscope’s ability to develop children’s confidence in speaking and listening. Teachers found that when working with the microscope in pairs or small groups, pupils were keen to talk about their observations and how they could use the microscope. Many children became more animated at such times and the quality of their descriptive language surprised teachers. In particular, an increased quality was observed in the discourse of pupils with special needs and children learning English as an additional language.

Project teachers exploited this aspect by using the microscope to develop children’s ability in:

- discussion
- persuasive argument
- descriptive writing
- use of vocabulary
- instructional writing
- creative writing.

Teachers also found the microscope had potential to support art because it allowed children to see objects from a very different perspective, showing detail and pattern that they could not see with the naked eye. Many teachers used the microscope to develop children’s ability in observational drawing and pattern making.

The microscope also appeared to increase children’s ICT skills and encouraged their creativity. It allowed them to access, from a single package, facilities that required skills beyond those used with basic paint and word-processing programs. For example:

- digital photography
- production of video material

- cut and paste facilities
- word processing
- special features such as the ‘fly’s eye’ and ‘stickers’.

Children with special educational needs and English as an additional language

This was another important outcome. All teachers commented on how well children with special needs worked when the computer microscope was used. The pictorial nature of the instructions made the microscope readily accessible and this allowed most children to experience a high level of success in using it.

Also, where the microscope was introduced to the whole class all children had the same starting point therefore no one was at an advantage in terms of prior knowledge. The use of an interactive whiteboard to control as well as display the results from the microscope also enabled more children to access the microscope effectively and with confidence.

Progression

The research suggests that there is a continuum of use for the microscope. In project schools, at the Foundation Stage its use required the support of an adult. In contrast, by upper Key Stage 2 almost all children used the microscope independently.

In the Foundation Stage, the teacher or adult helper produced stimulating images and materials that the children used in a variety of ways. Although some children of this age can use the microscope to view objects independently, they are not always able to access and use the range of facilities it offers. Above the Foundation Stage, once children were familiar with the different facilities, the issue of progression hinged on the complexity of the content.

Use of the digital microscope before the project

The questionnaire data and discussions with teachers suggested that the way schools received the computer microscope influenced what they did with it. The microscope was delivered to primary schools without widespread publicity, and without a covering letter explaining why it had been donated and how it could be used. Since most schools were not expecting the microscope, its uses were not immediately explored.

In many of the project schools the microscope was immediately placed in a cupboard for safekeeping. In some instances this happened without the relevant staff (science and ICT co-ordinators) being told about its arrival. In a few cases, it was ‘forgotten about’ for some time. This behaviour may be relevant to the planning of further national initiatives involving primary schools.

Other observations

Observations showed that project teachers seemed competent in using the digital camera and the computer as tools, for example, for word processing. However, they appeared less confident about the use of peripherals and the use and manipulation of graphics (other than those from digital still cameras).

Schools appeared to be unfamiliar with installing software for peripherals and connecting equipment, particularly with networked computers. One of the least valued and least used ICT-enabling technologies was that of discussion groups and chat rooms. And, although these had been set up for the project’s teachers, they were not used.

Conclusions

In this project, a key outcome was the microscope's clear ability to motivate. The motivation and excitement it engendered encouraged pupils to talk enthusiastically, not only about their findings but also about the process of using the microscope. The children were keen to teach others to use it and their communication was not restricted to the work group or class – most would talk to anyone who would listen.

This increased motivation and enthusiasm had an effect on pupils' language skills, in particular their ability and confidence in speaking and listening. When discussing their discoveries, or talking about how to operate the microscope, the range of descriptive language was above the 'norm'. Significantly, this included those children with special needs or English as an additional language.

Enhanced motivation was also evident in science. Because the microscope enabled pupils to examine things in detail, it enabled them to grasp difficult concepts more readily – seeing aided comprehension. This increased comprehension, coupled with the sense of excitement at being able to see things not normally visible to the human eye, increased pupils' enthusiasm for the learning and their ability to retain and reproduce the detail of what they had learned.

The enthusiasm with which children used the microscope also rubbed off on the teachers. By the end of the project, the competence and confidence of teachers in using the microscope had improved. Perhaps more attention needs to be given to the role of 'children as experts' when considering how to embed ICT into the wider curriculum?

A computer microscope with the range of facilities of the Intel Play QX3 acts as a comprehensive ICT resource since it allows children to produce digital photographs, video recordings, text, and a range of graphics without having to wait for additional equipment to be set up. In this project it appeared that children developed their ability to use a wide range of ICT skills and applications much faster than normal simply because the microscope was a 'one stop ICT shop'.

Among the participants in this project, this easy to use, feature-rich product was deemed a powerful tool for learning.

As one teacher commented:

"The digital microscope gets away from the idea that a computer is a thing in itself and moves teachers towards using it as a means to an end and a way to make things happen."

Recommendations

1. Effective dissemination of information about this product to all maintained primary schools by way of a 'reminder' about its potential and the ways in which it can support the curriculum. (This could be achieved through a targeted publicity campaign and by developing a website and/or a CD-ROM containing materials and case studies from this project.)
2. Further research into the use of computer microscopes in science, literacy, and the wider curriculum, with wide dissemination of the results.
3. Further research into the features of the Intel Play Microscope and how these enhance learning in the primary phase.
4. Provision of training to trainee teachers, particularly those on science and ICT courses, in the use of such innovative products.

5. Dissemination of information about the potential of this and similar equipment by the science and ICT community in their journals and magazines. Early reviews of new and innovative educational ‘play’ products.
6. Application of appropriate dissemination policies in national initiatives involving the primary sector.