ALL KEYED UP

The use of computers, at home and at school, by children with special needs

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This article describes the findings from a research project by the New Zealand Council for Educational Research and the Special Education Services (SES), which looked at the use of computers by children with special needs.[1] This article provides some information about how the use of computers benefits children with special needs, the role of the family in the learning process, the importance of professional development, and the conditions which assisted the children to obtain maximum benefit from their use of computers.

Background

The benefits of the use of computers

The benefits stemming from the use of computers by children with special needs are widely acknowledged by educators both in New Zealand and elsewhere, for example, Ryba and Selby suggest that "the idea of using a computer as an empowering tool to give students control over their learning is widely accepted".[2] This opinion is shared by Viadero who asserts that the benefits stemming from the use of computers (or IT, information technology) by students with special needs are more clearly defined than for other students:

> While mainstream educators continue to debate the merits of buying expensive educational technology for schools, special educators engage in no such argument. Technology has literally helped open schoolhouse doors for disabled students and given impetus to the 'full inclusion' movement, which calls for teaching disabled students in regular classrooms whenever possible.[3]

Viadero suggests that the main benefit of the use of computers is its capacity to enhance a child's communication by assisting the child to write clearly and therefore to be understood more readily, to keep pace with other class members, and to produce more presentable work.

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Factors which support the successful use of computers

Family involvement

One factor mentioned in the literature concerning the use of computers by children with special needs is family involvement. Bovenkerk, Kaiser, and Morningstar all emphasise the vital role of the family.[4] The Ministry of Education echoes this position by suggesting that:

> If parents, grandparents, brothers, and sisters know how to tutor properly, then they could continue the practice and fluency components of a teaching programme and become real partners in the teaching process for students with special needs.[5]

Professional development of teachers

Another factor often discussed in the literature is professional development. McCarthy, in a study of teachers of students with special needs in Wellington, found that teachers did not receive sufficient training to suit the individualised situation of the children they worked with, that is, training concerning how to use computer software and hardware, and how to relate software to students' educational needs.[6]

McCarthy observed that teachers were not taking the major responsibility for students with special needs when they used computers. This responsibility had been passed to teacher aides. Teachers reported that they had insufficient time to learn how to use the computer software for one or two students who may have hardware and software different from other students. This pattern has been identified by other authors.[7]

Is the potential of computer use being realised in New Zealand?

While reviewing the use of technology by students with special needs in New Zealand, Hutton suggested that there are limits on the full and effective use of this technology which originate from:

- the lack of training of classroom teachers,
- the lack of funds to buy software and peripherals,
- a lack of computer maintenance,
- more instruction being given to the teacher aide than to the teacher, and
- too little regard for children's educational use of computers.[7]

Some of these limitations, as suggested by Hutton, are discussed by Hutinger. Hutinger outlines a number of conditions which she sees as essential for the successful use of educational technology in teaching students with special needs:

> Several conditions are necessary for a comprehensive technology program for young children with disabilities: staff training, administrative support and technology policies, appropriate assessment and individualized programming, family involvement, and transition plans. Families must be involved in important decisions regarding their children's technology experiences. Although the attitude, training, and inventiveness of the staff closest to the child's educational program play a crucial role in whether any child will make the most of any

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technology application, optimal outcomes result from collaboration between home and school.[8]

Purpose of the research

The research project on which this article is based looked at the effects of computers on the learning of children with a disability, in their home and school environments. It focused on computer use in the home and school or early childhood education (ECE) centre, and in particular examined:

- whether computer use contributes to the achievement of the Individual Education Plans (IEPs) of children with special needs,
- how the family can assist the learning of children with special needs,
- what relationships exist between the home and school which may contribute to a child's learning, and
- what factors of computer use lead to maximum educational benefit for a child with a disability.

The issues that Hutton raises about training, support, maintenance of the computer, and the use made of computers were also examined in this study.

Outline of the study

Due to the individual situation of each child, the study reported here was designed as a multiple case study, involving 12 children; 10 boys and two girls, aged 4 to 11 years. The children were selected randomly from a group of children with special needs who had been recently assessed by SES for their educational needs and computer requirements. From this assessment these children were provided with technology to assist their learning. This assessment was evaluated at periodic intervals.

The children were located in three geographical areas and represented a cross-section of children with special needs. Most of the children in this study used the computer equipment provided to them in two locations—at school or at an early childhood education (ECE) centre, and at home.

At the start of the study two of the three under 5-year-olds in the study attended an ECE centre; the other children attended primary school. All of the children were described as having high or very high needs using a set of criteria which was developed from discussions with SES staff, and included some of the categories used by the Ministry of Education for Ongoing Resource Scheme applications.[9]

The major aim of this study was to examine the effects of the use of computers on the learning of the children in both these environments by identifying or collecting information on:

- whether the use of computers assisted the children to meet their learning goals as set out in their Individual Education Plans (IEPs);
- any transfer of skills and knowledge, regarding the use of computer equipment, which occurred within the family;
- any two-directional knowledge transfer which occurred between home, school, and other locations;
- conditions which provided the maximum benefit from the use of computers; and
- support and training available to educators and family members.

Information for the study was collected over approximately six months, from both home and school/ECE centre, in two phases during 1997 and 1998 by a SES field worker familiar to the child. Data were collected via a series of interviews, videos, observations, and profiles.

Did the use of computers assist children to meet their learning goals?

A comparison of the children's skills over time showed that all the children were observed or reported to be either meeting or making progress towards meeting, through the use of computers, the educational goals outlined in their IEPs. Some children made only a few advances related to their goals, others were observed to be meeting most of their goals. For example, one child showed:

- greater letter and word recognition,
- increased recognition and understanding of mathematics symbols, and
- increased social interaction, such as answering questions, following directions, and asking for help when needed.

Written, spoken, and oral language development formed a large part of most of the children's IEPs. It was apparent that the children's language development, in particular, was assisted through the use of a computer. The visual and audio presentation of text enhanced the children's ability to recognise, read, and use language and to share their communications with those around them, for example:

> Loves to go on, hard to get him off [the computer]. He is at his most verbal (he mixes signs with speaking), he's very talkative and interactive. (Parent)

In 1997 a parent said:

> He has good computer skills—he's in and out of programs and drags with the mouse.... He's learnt the alphabet, recognises numbers up to 10, and is developing his language skills by recognising words such as "up" and "down".

In 1998 the same parent stated:

> He is learning to read—his sight vocabulary is growing, and he knows the alphabet. His

being in control has been a benefit—he has less opportunity for this elsewhere. His concentration is improving.

IEP coverage

The coverage and the construction of the children's IEPs varied considerably. Only one child's observed improvements all matched his IEP goals—this child had the most comprehensive IEP in the study. All the other children made progress in areas not covered by the IEP goals. Many of these achievements were in the areas of communication, self-management and self-esteem, and computer skills. Most children were observed to be improving their computer operation skills, for example, one child who used a single switch continually and randomly in 1997 had gained a greater realisation of cause and effect. By 1998 he only clicked on the switch when necessary.

The more comprehensive IEPs in this study listed:

- the child's current attainments or level of functioning,
- short-term goals for the child,
- long-term goals for the child,
- the resources and strategies used to achieve these goals,
- the people responsible, and
- how attainment of the goals would be evaluated.

Most of the IEPs had some but not all of these categories. In some IEPs the use of computers was integrated into the short-term goals, in others it was specified in a separate section, and in some it was barely mentioned, or not included. Children for whom computer use was an integrated part of their IEP goals and strategies appeared to have more focused use of their computers both at school and at home. Two examples of this integration are shown below. These IEPs stated that the children would work with their teacher aide to:

- use Maths Blaster and computer games to develop basic numeracy, for example, understanding of basic facts for numbers 0 to 10, simple addition and subtraction, and counting in 1s and 10s;
- find letters on the keyboard independently; choose letters to write own name; initiate the ideas and illustrations for stories using the computer or by hand—to be achieved through daily use, practice, and reinforcement of own name, alphabet cards, printing, and computer stories.

IEPs which were less focused than the above contained broad goals but no sub-goals, and did not include reference to how the computer software was to be used. For example one IEP simply stated that the child would work with support people, within the class programme, to gain reading fluency.

Other benefits from the use of computers

All but one of the parents, and nine of the educators, thought that the children were generally benefiting from the use of computers. All but one of those who were unsure of the overall utility of the equipment also identified some areas of benefit for the child. The benefits most often reported and observed for the children were enhancements in:

- written, oral, or visual language skills,
- motor skills,
- computer operation skills,
- concentration,
- communication skills,
- self-management and independence,
- motivation and self-esteem, and
- work completion skills.

For example, one teacher aide reported that the use of certain software had enhanced the child's motor skills which helped in mathematical ability:

> He's learnt mouse skills, co-ordination, understanding of maths concepts for example discriminating length (he can't do this with physical objects). He seems to be ahead on the computer.... He gets a choice and he can nonverbally "answer". (Teacher aide)
>
> She has a sense of controlling the environment. (Teacher aide)

A number of personal milestones for the children, which were due to the use of computers, were reported by educators, for example:

> We told his parents when he used his first two-word utterance "bye boat" which came directly from a computer program.

The use of computer equipment provided most of the children in this study with more opportunity to function in the mainstream as, through the use of computers, they participated more in classroom programmes, interacted with their peers, operated independently, and had more control over their environment, for example:

> It gives him something to talk about. He can help other kids learn about the computer. He writes stories on it, demonstrates to other students. He shares his computer with others in the class. He is the teacher. (Parent)
>
> It is one of the most enjoyable times he has at school—especially with his peers. (Teacher aide)

An increased ability to communicate was the major factor which encouraged this participation. Other important factors were the children's enjoyment in using computers and the effect that this enjoyment had on their motivation to learn, for example:

> Says "more". Tells you when she is finished. She would stay at the computer as long as you let her. (Parent)
>
> His output goes up when he uses it. He talks constantly about the computer. (Teacher aide)

Another factor which encouraged the children's participation was their growing independence. By 1998 most of the children in this study were using their computers more independently both at home and at their school/ECE centre, for example, in 1997 one parent reported:

> He's mastered "on" and "off", the mouse (hand to eye co-ordination) and generalised this to the video player.

In 1998 this parent stated:

> He is more confident at finding his way around programs and more independent.

In 1997 approximately half of the educators reported that they had noticed improvements in the children's behaviour when they worked on the computer, for example:

> He is a completely different child [when he uses the computer]. It is difficult to get work done otherwise. (Teacher aide)

Did all the children benefit from the use of computers?

Two of the educators and one of the parents interviewed were unsure as to whether the use of a computer assisted the children's learning. Some children were observed to be making fewer gains in relation to their IEP goals than others.

An increased ability to communicate was the major factor which encouraged participation.

There were a number of reasons for this; some concerned the unsuitability of the equipment provided to the child, others concerned the nature of the child's disability which did not allow them to process information rapidly.

Interaction between home and school

Another major aim of this study was to examine if, and how, knowledge was transferred between the school and home environment.

The 12 children were in the middle of an interconnected web of information transfer which occurred within and between home and school. All children worked with at least two or three people either at an ECE centre, at school, or at home. Knowledge about how to use the software and hardware was transferred in all possible directions between educators, parents, children, siblings, peers, the children's friends, extended family members, and caregivers. By 1998 the range of locations in which the children were using computers was increasing.

Parents and educators reported a variety of benefits from the children's use of computers, including enhancement of the children's language skills, computer operation skills, communication skills, and ability to work independently.

The main direction of this transfer of knowledge was from educators and parents to the child, although some children also showed their teacher aides, peers, and parents how to operate aspects of the software and hardware they were using, for example:

> He has shown me how to move the CD-ROM out. (Parent)
>
> We have always had computers at home—he knows how to network and play a game on three different computers. (Parent)
>
> He shows classmates how to use the computer. (Teacher aide)

A theme which emerged during the course of this study was the vital role that parents and other family members had in encouraging and supporting the children's learning. Many of the children had initially learnt to use a computer at home, and for many children the same activity, using the same software, was carried out at school and at home. All parents used the Government-funded or home computers with their children for a variety of activities, for example, developing mathematics and language skills, or completing homework projects. Most of the children also used computers with their siblings.

How important are support and training?

One recurring theme which surfaced throughout this study was a lack of confidence by some parents and educators in using the equipment provided. While watching the videos it became apparent that there were differences in educators' and parents' knowledge of how to operate the hardware, the options available in the software, and how to use these options to assist the child's learning.

Half of the parents interviewed had no formal training on the equipment they were using and educators were in a similar position. The majority had learnt their computer skills on-the-job, few had attended any formal training on the system they currently used.

Some educators were concerned about their technical skills, and the majority of teacher aides considered that they required more learning support training. This lack of training and computer confidence influenced educators' and parents' ability to assist the children they were working with.

How did parents and educators maximise the potential of the computer equipment?

One of the aims of this study was to present some information on the conditions which assisted the children to obtain maximum benefit from the use of their computer equipment. The use of positive coaching strategies was one way by which the children were assisted.

The coaching strategies used by the people who worked with the child in this study varied. The educators who were trained educational professionals, and who rated themselves as confident computer users, tended to use more positive strategies such as modelling and frequent praise.

Some strategies which assisted the children were:

- Modelling new tasks to the child.
- Repeating tasks until they were mastered, using hand-to-hand facilitation if necessary.
- Using frequent praise and positive encouragement and reinforcement; focusing on what the child was achieving rather than what they were not.
- Actively, rather than passively, engaging with the child to encourage mastery of existing skills and development of new skills, for example, by demonstrating, prompting, and questioning.
- Dividing tasks into manageable chunks relative to the child's skill level (for example, encouraging the child to type a word at a time rather than a sentence).
- Selecting tasks which encouraged the child's creativity (for example, typing stories created from the child's ideas).
- Encouraging independence and self-empowerment by ensuring that the child was not prompted or assisted unnecessarily (for example, checking with the child if they could spell a word before assisting them).

On the whole most of the interactions observed between the children and others were positive, though educators tended to use more of the strategies listed above than did parents. Both parents and educators sometimes over-prompted the children, or typed or read for them in order to get a task done in a shorter time. This could be disempowering for some children who were prompted for activities they had already mastered.

Parents were less likely to actively engage with children to encourage their learning, for example, using questioning as a means to enhance the child's learning. A few people who worked with the children used phrases such as "no", and "don't do that", rather than encouraging or modelling the behaviour they wanted by actions or phrases such as "good waiting", "good checking", "well done, you did it" or "what goes at the end of a sentence?" On the whole however, all of the parents and educators used at least some of the positive coaching strategies mentioned above.

Summary

The use of computers assisted all the children in this study to meet, or to make progress towards meeting, their educational goals as defined in their IEPs. If the time period had been extended, more progress would have been made. All but one of the children were making educational improvements, facilitated by their use of computers, outside their IEP goals.

Nearly all the parents and educators interviewed considered that the use of computers was a beneficial and positive experience for the children which enhanced their learning. Parents and educators reported a variety of benefits stemming from the children's use of computers, including the enhancement of the children's language skills, computer operation skills, communication skills, and ability to work independently.

The use of computer equipment provided most of the children in this study with more opportunity to function in the mainstream. Similar enhancements in communication and participation for children with special needs, via the use of technology, are reported elsewhere.[10]

One feature of this research was the web of knowledge transfer in the middle of which the children were positioned. Knowledge about how to use hardware and software was transferred in all possible directions by all the people involved in this study, though on the whole the main direction was from educator and parent to child.

Two recurring themes concerning professional development surfaced throughout this research, that is, the lack of training provided for many of the educators and parents who were using the computer equipment with the children; and for some, a corresponding lack of confidence in using the equipment. This lack of training was in two areas:

- operating the hardware and software, and
- supporting the children's learning using the software.

This lack of training and confidence hampered the ability of educators and parents to support the children in this study, and is reported elsewhere.[11] Ensuring that the use of computer equipment was integrated into the IEP development process could be one way of assisting educators and parents to develop knowledge about how to assist children's learning through the use of computers.

Along with educators, the parents and other family members in this study played a vital role in encouraging the children's development of skills. This study highlights the necessity for ongoing training for *all* the people who work with children with special needs either at home, in an ECE centre, or at school. This training needs to include teaching techniques and behaviour management skills applicable to the needs of individual children.

This research also highlights the importance of developing and maintaining communication links between home and school to ensure both parties are aware of children's educational goals and are working together to achieve these goals.

From this study some conditions which could maximise the educational benefits from the use of computers for children with special needs were identified. Many of these conditions are supported by other research.[12] These conditions were that:

- the children have daily access to functioning computer equipment,
- the people who work with the children view themselves as knowledgeable and confident computer users,
- the people who work with the children are trained in the use of teaching strategies to encourage the children's learning, communication, and independence,
- the people who work with the children use positive coaching strategies,
- the software and hardware used by the children is seen as appropriate by both educators and parents,
- computer use is integrated into IEP strategies for oral language, reading, writing, mathematics, and cognitive and social development rather than focused on as a separate section or not included,
- there is an awareness at both school and home of the children's educational goals and the programme of computer use occurring in the other setting, and
- those in the home and school environments are satisfied with the level of contact between the two locations.

It is essential that these conditions are taken into consideration at the time equipment is provided to ensure that children with special needs are able to take advantage of the benefits possible from their use of computers.

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NOTES

1. For more detailed information on this study see:

Harris, D., & Boyd, S. (1998). *A link to learning: The use of computers by children with disabilities.* Wellington: New Zealand Council for Educational Research.

2. Benefits from the use of computers by children with special needs quote, page 157 of:

Ryba, K., & Selby, L. (1995). Empowering learners with computers. In D. Fraser, R. Moltzen, & K. Ryba (Eds.), *Learners with special needs in Aotearoa/New Zealand* (pp. 156–177). Palmerston North: The Dunmore Press.

3. That benefits for students with special needs are more clearly defined than for other students is from page 14 of:

Viadero, D. (1997). Special assistance, technology is revolutionizing instruction for disabled students. *Education Week, XVII* (11), 14.

4. Importance of family involvement in using computers:

Bovenkerk, A. (1994). Dimples in my thigh: The effects of parental interaction within close physical proximity. *Journal of Special Education, 18* (2), 157–164.

Kaiser, A. (1996). The effects of teaching parents to use responsive interaction strategies. *Topics in Early Childhood Special Education, 16* (3), 375–406.

Morningstar, M. (1996). What do students with disabilities tell us about the importance of family involvement in the transition from school to adult life? *Exceptional Children, 62* (3), 249–260.

5. Quote on importance of family from page 14 of:

Ministry of Education. (1998). *Managing the special education grant: A handbook for schools.* Wellington: Author.

6. Teachers' lack of training in using computers:

McCarthy, J. (1995). *The effective use of computers by special needs students in the mainstream.* Unpublished dissertation submitted in partial fulfilment of the Diploma in the Education of Students with Special Teaching Needs, Wellington College of Education.

7. That teachers report lack of time to learn new computer software:

Hutton, R. (1997). Computers and the child with special learning needs: Salvation or sham? *Computers in New Zealand, 9* (2), 19–23.

8. Conditions essential for the successful use of educational technology, page 106 of:

Hutinger, P. (1996). Computer applications in programs for young children with disabilities: Recurring themes. *Focus on Autism and Other Developmental Disabilities, 11* (2), 105–114.

9. Ongoing resource scheme:

Ministry of Education. (1998). *Special education 2000 ongoing resourcing scheme for school students with high special education needs. Application form.* Wellington: Author.

10. Enhancements in communication and participation due to the use of technology noted by:

Semmel M., & Lieber, J. (1990). Technology applications for infants and preschool children with handicaps: A review. *International Journal of Special Education, 5* (2), 160–172.

Viadero (1997), see note 3 above.

11. Problems caused by lack of training and confidence:

Hutton (1997), see note 7 above.

McCarthy (1995), see note 6 above.

12. Other research on maximising the educational benefits from the use of computers:

Hutinger (1996), see note 8 above.