

MAKING SENSE: RELATIONS BETWEEN LITERACY, TELEVISION AND COMPUTER USE AND OTHER USES OF CHILDREN'S TIME

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INTRODUCTION

One of the findings from the Competent Children project which attracted attention in the newspaper and radio coverage of our latest report was that children who watched more than few hours of television a day, on average, tended to have lower literacy and mathematics scores. It's also a finding which interests parents, and which they have already used with children to back decisions to limit the amount of time they can watch television. Interestingly, there was less media interest in our findings on home computer access and use, and I've had less feedback from parents about these too. Yet both television and computers have been seen as competitors with activities which are valued developmentally: particularly reading, play with other children, games and physical activity. In this paper, I want to outline our findings from the Competent Children project about the relationships between television watching, computer use, and literacy and explore what it is about television watching that does appear to compete with literacy activities and performance, compared with computer use.

The Competent Children project is a longitudinal study of around 500 children from the Wellington region, funded by the Ministry of Education. It has followed the children from age near-5, with data collection at age 6,8,10, and, just completed, age 12. Four full reports have been made, one after each phase¹ with the next report including the age-12 data due for completion at the end of 2002. The main aim of the study is to chart the contributions to children's progress that are made by some of the main experiences and elements in their lives, including family resources, early childhood education, school experiences, their interests and activities, and their relations with their peers. The study includes a wide range of likely factors, which means we can compare their contributions, and put them in context.

We don't assume that children are the result of mechanistic processes, or simply the sum of their resources and experiences. The factors which are analysed include perceptions as well as experiences, or the use of time. The particular value of a longitudinal study is that it can give some understanding of the relationship of previous experiences to current perceptions and performance, and therefore allow us to weight those experiences for their long-term as well as short-term value.

In the Competent Children project, our main analysis of value has been in terms of a range of 10 'competencies', or aspects of knowledge, skill, and dispositions, which appear to be linked to positive participation in learning, work, and social relationships. These are: literacy, mathematics logical problem-solving, fine motor skills (measured

¹ These are:

Wylie, C., Thompson, J., & Lythe, C. (2001). *Competent Children at 8 - Families, Early Education, and School* Wellington: New Zealand Council for Educational Research.

Wylie, C., Thompson, J., & Lythe, C. (1999). *Competent Children at 8 - Families, Early Education, and School* Wellington: New Zealand Council for Educational Research.

Wylie, C., & Thompson, J. (1998). *Competent Children at 6 - Families, Early Education, and Schools*. Wellington: New Zealand Council for Educational Research.

Wylie, C., Thompson, J., & Hendricks, A.K. (1996). *Competent Children at 5 - Families and Early Education* Wellington: New Zealand Council for Educational Research.

through tasks undertaken by the children) communication, perseverance, individual responsibility (self-management), social skills with peers and with adults, and curiosity (measured by teacher ratings).

TELEVISION AND CHILDREN'S PERFORMANCE

INTERNATIONAL OVERVIEW

Television viewing and its relation to children's cognitive, physical, social, and emotional development has produced a wide range of research studies. Walters and Zwaga (2001) note both positive and negative effects, citing studies which show that

viewing moderate amounts of non-violent television has been found to stimulate children's creative abilities, enhance their educational performance, and to inspire, develop curiosity and improve their spoken vocabulary and language development (p. 35).

They summarise its negative effects in terms of physical and emotional development, which largely stem from extensive viewing, particularly of violence.

Van der Voort (2001) provides a most useful overview of research on the relation of television viewing and children's reading. First, he describes several kinds of evidence that television does compete with reading for both children's and adults' attention, including longitudinal time-use studies of the decline in reading for leisure in the Netherlands after the introduction of television and then its expansion into more day-time hours, and a number of 'TV-restriction and TV deprivation' studies.²

He notes only 3 longitudinal studies over a three-year period. Two of these studies found a positive but small relationship between the amount of time spent reading and prior television watching (both amounts given by children). These were with children who were aged 1-12 at the start of the research. Van der Voort suggests that the main reasons for this finding were that the children had already established their reading habits, and that the measure of book reading was too aggregated. His and Koolstra's 1996 Dutch study focused on 8 to 10 year-old children, who 'had just begun to develop reading habits' (p. 103), and analysed effects on different kinds of reading, and reading attitudes, as well as the total amount of reading. They found the earlier television viewing did reduce the frequency of children's book reading, but not their reading of comics. They suggest that this effect is due to two causal mechanisms: television makes children feel less positive about reading books, and reduces their ability to concentrate on reading.

² Since the focus of this paper is literacy, I have not attempted to cover research focused on other aspects of children's development. Another review of research on television and child development which provide good coverage of findings and issues is Van Evra (1990). Two recent reports from an experimental U.S. study show small positive trends for reduced aggression and obesity, through reducing television watching for children aged 8-9, Robinson (1999) and Robinson et al (2001).

Does it matter if children read less and watch more television? Say yes, and in some eyes you are a kill-joy, an elitist, or simply old-fashioned, resisting the digital age. Say no, and in some eyes you are too casual about the often simplistic, bite-sized, or violent content of television, and the time which it swallows. Thus I particularly enjoyed van der Voort's eye for balance:

Television and the printed word each have specific merits and limitations, and there is little evidence that the one is better than the other. I do think, however, that children's cognitive development is better served by a balanced "media mix", a pattern of media use that accommodates both television viewing and reading. When television takes the place of reading one can enjoy the fruits of one medium, whereas a more balanced mix provides opportunities to profit from the specific merits of each of the media used. (p. 104).

He then summarises experimental studies showing some very interesting differences in children's processing of stories which show the different nature of the two media. The moving visual image offered by television allows better long-term memory of a narrative - but less encouragement to introduce new ideas; written language allows more clarity about characters, encourages children to use more expressive language, and to invent new ideas. It appears to offer more room for thought and support for language use. Language is the minor player in television: Liberman (1986) analysed scripts from 15 U.S. favourite teenage programmes and found limited lexicons, short utterance and sentence length, simple sentence structure, and little use of figurative language.

Observational studies of family and children's use of television have noted that television viewing is often interwoven with other activity, including conversations, play, and computer use, leading to cautions about estimates of children's viewing time, and the effect of viewing time per se (e.g. Lealand 1995). However, van der Voort cites a number of studies showing that combining reading with television watching has adverse effects on reading performance, in the short-term: no long term studies have been done.

Van der Voort cites four longitudinal studies of the effect of television viewing on reading achievement. Each of these finds current negative associations, as do most concurrent studies³ but three of the four find no relationship between earlier television viewing and later reading achievement. Koolstra and Van der Voort's 1997 study did, largely because it used more specific measures of television viewing - types of programmes, looked at both reading comprehension and decoding skills, and appears to have followed younger children. This study found that whereas there was a small non-significant positive effect from watching informational programmes, watching entertainment programmes had a small negative influence on reading comprehension. The processes which underpinned this involved not just television viewing however, but also the fact that children who initially score highly for reading comprehension are likely to have read more books, and

³ New Zealand examples are found in Lamb (1987), who noted that New Zealand low achievers in the IEA writing study tended to watch more television than the high achievers, Caygill (1993), who found that students in the 1990 IEA reading study who watched less television than others had higher scores for reading, and Rogers (1994), who found a negative correlation between the amount of time children spent watching television and their reading test scores, in a study of 125 Christchurch Form I students.

to have a more positive attitude toward reading. They also seemed to have somewhat different preferences for television programmes.

There is a final point to emerge from this valuable overview. The size of the effects found is small, partially due he suggests to the relative stability over time of both the amount of television viewed and reading comprehension, the limited age-range of these studies, and their limited duration (3 years at most); and partially to the perhaps more diffuse effects of television watching compared to the major focus on reading comprehension which occurs in schools.

FINDINGS FROM THE COMPETENT CHILDREN PROJECT

The Competent Children study allows us to explore the relationship between children's television watching and their later literacy over a longer time-period than the other longitudinal studies cited by Van der Voort, and from a younger age, from before the children were exposed to directed teaching to turn them into readers, to the age of 10, where all but one child in the study was reading independently - though almost one in five did not enjoy reading.

We have used television viewing amounts for our analyses, of which two kinds are reported here. The first looks separately at associations between the amount of television watched at ages 5, 6, 8, and 10, and between the amounts of television watched by parents at ages 8 and 10, and the measures of each competency at age 10. Literacy was measured in four ways: PAT reading comprehension score, Burt word recognition (vocabulary) score, a score for writing task that asked children to describe a favourite book or television programme, and give their judgement of it;⁴ and teachers' estimate of the child's reading age. The second kind of analysis includes the amount of television watched in multifactor modelling, for reading comprehension. These models were not done for all the literacy measures.

Television watching has more association long-term with children's literacy and mathematics than with their social skills or dispositions, such as perseverance. There are several reasons why this might be so. First, in the Competent Children project, social skills and dispositions appear to be more contextually dependent and less stable over time than literacy and mathematics. Second the overseas research would suggest that the medium is indeed the message. Television's essence and strength is its visual nature, and this can occur at the expense of language. Third, if television viewing competes with other activities, as it appears to do, indoor activities are likely to be those that change, and reading may appear less attractive by comparison to children whose language use is not strong. Finally, it appears, as van der Voort suggests, that television watching habits are reasonably stable over time, so that watching television for large amounts before starting to learn to read may have displaced some of the room which

⁴ Van der Voort cites a study showing that it was easier for children to summarise a story they had read than one they had viewed; we can explore this with some further analysis of children's writing scores in the Competent Children project, and the dimensions they scored well on, in terms of whether their chosen topic was drawn from television or print.

reading could occupy: the room which lets us into other lives and stories as well as the comfort of the familiar, stories which have ends as well as beginnings.

The tables that follow give the results of analysis of variance, with the average score for each amount of television viewing given in percentage points with its probability, and the proportion of variance accounted for (in separate models rather than a single model adding to 100 percent) The results are independent of family income and parental qualification levels.⁵

TABLE 1

TV WATCHING AGES 5-10 AND PAT READING COMPREHENSION AGE 10 SCORES

TV Watching	None	Up to 1 hr	1<2 hrs	2<3 hrs	>3 hrs	Prob	% variance	(Percentage points largest gap)
Age 5	60.9	54.1	50.1	43.8	38.9	0.0006	7.1	22.0
Age 6	52.6	53.1	46.7	44.9	32.3	0.005	5.4	20.3
Age 8	66.8	54.0	47.0	43.1	43.2	0.000001	6.6	23.6
Age 10	65.0	55.3	48.1	41.9	42.1	0.0000002	7.7	22.9

Unlike the Dutch longitudinal study of older children over 3 years, the 'effect' seems not small: the gaps between the highest and lowest scores are quite high. Unlike a recent meta-analysis combining international comparative data for 9,13, and 17 year olds, including reading, science and mathematics marks (Razel 2001), the trend is linear rather than curvilinear. Razel estimates some 'optimal' television viewing amounts beyond which current television viewing appears to have negative rather than positive effects: his data are not longitudinal.

Television watching amount 5 years earlier appears to have about as much effect on New Zealand children's reading comprehension scores at age 10 as their current television watching. Comparing these results to the overseas studies undertaken with older children suggests that the amount of television watched has more impact on the *development* of reading comprehension, than on its *maintenance*, and that the effect can be sizeable during this important phase of developing the skills and practice of literacy.

In the multifactor model of the variance in children's PAT reading comprehension scores, current television watching (which will have subsumed earlier habits) is one of 11 factors, each making a separate contribution to account for 57 percent of the variance between their scores, and it was the factor that made the largest difference⁶.

⁵ Measured in this analysis by maternal qualification, since most of the parents interviewed are women, and around fifth of the families are sole-parent.

⁶ Also in this set were (in order of the size of the largest difference between scores in relation to the given factor): homework, parental support for the class, child sees school progress in terms of solving a problem by working hard, child enjoys reading, family computer ownership at age 10, final early childhood education centre socio-economic status (subsuming early childhood education quality aspects), the availability of print in the child's final early childhood education centre ('print-saturated'), child used library books at age 6, uses proportions other than 1/2 and 1/4, and could do times tables over 10.

The amount of television watched also seems to have more influence on reading comprehension than on vocabulary or writing scores, and current amounts of television watched, more associations than previous amounts. While there is a linear trend with vocabulary scores on the Burt word recognition test declining with the amount of television watched, the trend is not so clear-cut with writing, which shows different patterns for previous and current viewing amounts.

TABLE 2

TV WATCHING AGE 5-10 & BURT WORD READING TEST AGE 10 SCORES

TV Watching	None	Up to 1 hr	1<2 hrs	2<3 hrs	>3 hrs	Prob	% variance	(Percentage points largest gap)
Age 5	68.1	67.0	66.1	60.6	57.1	0.014	4.6	11.0
Age 6	66.2	67.5	64.2	54.1	57.6	0.002	6.1	13.3
Age 8	71.0	67.5	64.6	61.0	56.8	0.061	3.6	14.2
Age 10	75.6	68.4	65.4	60.2	58.3	0.00005	5.3	17.3

TABLE 3

TV WATCHING AGES 5-10 & WRITING AGE 10 SCORES

TV Watching	None	Up to 1 hr	1<2 hrs	2<3 hrs	>3 hrs	Prob	% variance	(Percentage points largest gap)
Age 5	73.1	70.5	73.7	68.7	66.6	0.021	4.3	7.1
Age 6	73.8	71.8	71.8	66.3	65.6	0.11	-	-
Age 8	70.8	73.8	69.0	71.5	66.2	0.001	3.5	7.6
Age 10	79.3	72.6	70.9	67.6	70.2	0.004	3.2	11.7

These analyses are consistent with van der Voort's explanation of the potentially negative effect of television viewing in terms of its competition for indoor leisure time, so that there is less practice in reading. Further descriptive data supporting this is given in the next section.

These analyses are also reasonably consistent with his explanations related to the relative weakness of television as a medium using and supporting language use, compared to the printed word, though one might have expected to see clearer and perhaps stronger associations between writing scores and the amount of television watched. It would be interesting to test this link further, by offering different writing tasks; our data will allow us to do some further analysis of the writing task given in terms of subject, surface features (including grammar), and deeper feature (structure, sense).

Overseas research does suggest that informational television can be of value in the short-term in contrast to entertainment, especially that including violence. Few of the children in the Competent Children study at age 10 mentioned documentaries or news as one of their three favourite programmes - possibly because they understood programme to refer to a named series. We did find that the heaviest watchers at age 10 (more than 3 hours) were much more likely to mention children's adventure or science-fiction cartoons (61 percent compared with 37 percent), but they were just as likely as others to mention documentaries or news. A more fine-grained analysis of the Competent Children data which looked at viewing amount over time, and included preferences over time within groups of light, medium, and heavy viewers along with information about the level of violence or language use in specific named favourite programmes could explore the impact of particular kinds of programmes over time.

THE ROLE OF TELEVISION IN NEW ZEALAND CHILDREN'S LIVES

Our picture of this sample of New Zealand children's television experience and its role in children's lives includes parental estimates of the average amount of time their child watched television every day from ages 5-10; from age 8, children telling us their three favourite television programmes, and children and parents telling us the three main things the children did after school. From age 8 we have also gathered information about the amount of time parents spend watching television.

This descriptive material indicates that television plays an everyday role in children's lives. Average time spent watching television was highest at age 5 (2.65 hours), dropped at age 6 (1.26 hours), and has been rising since (1.88 hours at age 8, and 2.20 hours at age 10).

These average figures are consistent with TV on Air survey data from children of the same age range. They are lower than figures given for U.S. and U.K. children, suggesting that though there is concern that New Zealand children are less physically active than previous New Zealand generations (or have a different, higher calorie diet), New Zealand children still have more opportunities for outdoor play than children in colder climates. Lealand (2001)'s recent survey of Waikato 8-14 year olds also shows a wide range of leisure activities.

Television heads the list of the main activities which children mention when asked an open-ended question about the three activities they spend most of their time on at home: 61 percent mentioned it at age 10, up from 42 percent at age 8. Video-games (21 percent at age 10, 4 percent at age 8) and homework (21 percent at age 10, 9 percent at age 8) are the other two activities which were mentioned more at age 10 than age 8. Reading (23 percent), physical activities (35 percent), playing with friends or siblings (31 percent), and computer use (19 percent) are at much the same level. In terms of perceptions then, rather than exact amounts of time, television is playing a larger role in children's lives at age 10 than at age 8, but it does not seem to have supplanted other activities it has been seen to compete with - at least in terms of the sample overall.

Half the parents also reported television or movie watching as a shared family activity when the children were aged 10, up from 37 percent at age 8, and 28 percent at age 5 but parents were less likely than children to see television as one of their children's three main activities (44 percent mentioned it; homework is also reported less by parents than children, but parents were more likely to mention reading, artistic work, and making things).

Television is a low-cost activity. The amount of television watched by children is related to family resources. In the Competent Children sample, the higher the income and parental qualification level, the less television was watched, both at age 5 and age 10. But low family income and education levels did not appear to be restricting children's participation in organised clubs and lessons out of school at age 10; low family income did not appear to restrict access to computers.⁷ So although low family income and educational levels may make television more practical as an activity, and more likely to occur in the household, it does not supplant other activities.

It is television use itself which might do this. Children who were watching more than 3 hour television a day at age 10 were much less likely to have lessons outside school (24 percent increasing to 45 percent of the children who watched for 1 to 3 hours, and 63 percent of those who watched for less than an hour a day, or not at all). Similarly, only 20 percent of the children watching for 3 hours or more a day played a musical instrument, increasing to 29 percent of those who watched for between 1 and 3 hours, and 52 percent of those who watched for less than an hour a day, or not at all.

But what is 'use'? Is it simply that children who watch television more have less time for other activities? Is it that television makes other activities less attractive?

We have some evidence to support the latter possibility, but it is mixed. Children's television watching was linked with parental views of their enjoyment of reading: only 13 percent of those who watched for up to 2 hours a day were reported by their parents not to enjoy reading compared with 25 percent of those who watched for more than 2 hours a day. But there were no links with enjoyment of writing, or mathematics activities.

When we look at children's reports of what they read, in response to an open-ended question there are no clear differences related to the amount of television children watch. Heavy television viewers do not read more comics than other children. When we look at parents' reports of what children read, in response to a list of reading materials, there are differences. Children who watched television for more than two hours a day were somewhat less likely to read nonfiction use an encyclopaedia or dictionary, or be reading adult books. But they use a library as often as others.

⁷ We did not seek information about the quality of these experiences, or the quality of home computers. Becker (2000) shows the quality of home computers and their internet access in the U.S. does differ according to parental income and educational levels; he also shows what appears to be a wider digital divide related to income and education in the U.S. than we found in the Competent Children project sample, which because it is based in the Wellington region tends to be higher income overall than the New Zealand nationwide picture.

Writing activities (reported by parents) do show some differences, with children who watched 3 hours or more being less likely to write letters, imaginative stories of more than 2 pages (but no difference in shorter stories), reports, and poems (but not plays). When we look at the perceptions of home and school which were most closely associated with children's performance on our competency measures, we find no clear patterns in relationship to the amount of television watched: heavy watchers were no less bored or restless than others.

Children who had a computer at home were less likely to watch television for more than two hours a day: 27 percent, compared with 41 percent of those who did not have a computer at home. This is consistent with U.S. national survey data showing children in households without computers watching television for an average 36 minutes longer each day than those in households with computers. Computer use did not affect time given to reading books or playing video games (on non-computer platforms) (Subrahmanyam et al, 2000).

One might take from this the possibility that computer use competes with television. However, in the Competent Children study, 10-year-old children who watched television for more than two hours a day were just as likely to have a computer at home as others, indicating that habits of television watching do not change quickly (Lealand 2001 also suggests this), and that the attraction of a computer might depend on what children can do with it. When we looked at computer use in relation to children's television watching, we found no clear patterns, and no major differences: heavy television watchers were just as likely as light television watchers to be wordprocessing, using graphics or the internet - or playing games.

We asked parents what they did with their child on the computer. Children who watched more than 3 hours television a day were less likely to have their parents alongside them when they used graphic packages or CD ROM's, or do homework (including projects), and those who watched television for two hours or more were less likely to use the internet with their parents.

This leads to one further clue perhaps as to why heavy television viewing may be associated with lower literacy scores, particularly for reading comprehension. Parental qualification levels are also reflected in their own amount of television viewing; these in turn are reflected in children's amount of television viewing. Children whose parents watched more than 3 hours television daily tended to show lower scores for the PAT reading comprehension and the Burt word reading test- but while this association remained when family income levels were taken into account, it did not when parental qualification was, indicating confounding of parental education and the amount of television watched.

Parental education levels are a major contributor to children's competency levels, separating particularly children whose parent has no qualification from others. It seems likely that that low educational levels will be particularly evident in language use, and

confidence and comfort in making everyday use of printed materials.⁸ The value of parental interaction with children while they are watching television - in terms of using the experience for discussion, clarification, and stimulation - is noted by Lealand (1995) and Wright et al (1990).

COMPUTER USE AND CHILDREN'S PERFORMANCE

The particular strength of the computer appears to be its potential for more interactivity than television or the printed word can provide. Roschelle et al (2000) describe some exciting studies of the use of this potential to engage students more actively in learning. Some of this interactivity stems from its fast processing of data, some from the use of software to allow students to construct '*presentations that reflect their understanding and knowledge of various subjects*', and the use of software to allow "*dynamic, linked notations*", which appears particularly advantageous for mathematics and its use; some from the opportunities it offers for collaborative work with others, and the discussions with others about the purpose and meaning of the work, which foster increased understanding. working with others on projects, or getting quick feedback.

This interactivity operates on a number of dimensions. It is not just a dynamic between one individual and another, or one's person's action on a keyboard in response to what appears in a software programme producing a different result from the person sitting alongside. It is also the use of the speed and the immense capacity for data of computers to show dynamic relationships which can be very complex to grasp through the printed word, even if diagrams or formulae are used.

Computer-based applications using visualisation, modeling, and simulation have been proven to be powerful tools for teaching scientific concepts. The research literature abounds with successful applications that have enabled students to master concepts usually considered too sophisticated for their grade level. (p.86).

But such gains do not always show up in results on standardised tests which are not designed to measure higher-order thinking; and it is difficult to integrate such new approaches to learning within traditional school structures. Thus the most powerful use of the interactive potential of computers for children's learning cannot be grafted easily onto existing ways of doing things.

This raises some interesting questions about children's actual use of computers, and the ability of home use of computers, which is what we asked about in the Competent Children project, to harness this particular strength. The associations we found between children's literacy performance at age 10, as we measured it – in a traditional way – and children's access to a computer at home, and their use of it – are not as marked as they are for television viewing.

⁸ This is consistent with Clarke & Kurtz-Costes (1997) finding that the children who watched most television among their near age-5 low-income U.S. sample had fewer books in their homes, were read to less by their parents, and had lower scores on a school readiness test.

This could simply be because we are not comparing like and like: we did not ask children or their parents for an estimate of how much time they were spending on the computer. But children do appear to spend less time on computers than watching television. In Lealand's 1999 Waikato sample of 383, 77 percent said they watched television daily, compared to 31 percent who played a computer or video game daily, and 9 percent who used a computer. A 1999 U.S. survey showed children between the ages of 8-13 with an average of 6 hours screen time a day – most of that television or video, with around half an hour for computer use (Subrahmanyam et al 2000).

The tables that follow show that a global measure of access - family computer ownership - appears to make more of a contribution to children's reading comprehension, and, to a lesser extent, vocabulary, than specific uses of the computer. There is little association between computer access and use and writing. There are no associations between use of a computer to play games (whether termed educational or not), and children's literacy scores at age 10.

TABLE 4
COMPUTERS AGES 5-10 AND
PAT READING COMPREHENSION AGE 10 SCORES

		No	Yes	Prob	% Variance	(Percentage points largest gap)
Age 5	Family Computer Ownership	44.7	53.5	0.001	4.0	8.8
Age 8	Family Computer Ownership	41.2	52.1	0.0000002	5.2	10.9
Age 10	Family Computer Ownership	38.5	51.7	0.00000002	6.1	13.2
Age 8	Wordprocessed	50.2	56.3	0.011	1.8	6.1
	Graphics	50.8	56.4	0.034	1.8	5.6
Age 10	Wordprocessed	50.6	53.1	0.25	-	-
	Graphics	50.8	54.3	0.16	-	-
	Internet	50.5	56.2	0.03	1.2	5.7

Table 5

COMPUTERS AGES 5-10 AND**WRITING AGE 10 SCORES**

		No	Yes	prob	% Variance	(Percentage points largest gap)
Age 5	Family Computer Ownership	70.0	72.1	0.22	-	-
Age 8	Family Computer Ownership	68.4	72.1	0.0013	2.0	3.7
Age 10	Family Computer Ownership	67.4	72.0	0.0005	2.3	4.6
Age 8	Wordprocessed Graphics	71.5	74.0	0.06	-	-
		71.8	73.8	-	-	-
Age 10	Wordprocessed Graphics	70.8	73.5	0.036	1.1	2.7
		71.8	72.7	-	-	-
	Internet	72.2	71.3	0.46	-	-

Table 6

COMPUTERS AGES 5-10 AND**BURT WORD READING TEST AGE 10 SCORES**

		No	Yes	prob	% Variance	(Percentage points largest gap)
Age 5	Family Computer Ownership	62.2	66.4	0.083	1.4	4.2
Age 8	Family Computer Ownership	59.5	66.6	0.00002	3.5	7.1
Age 10	Family Computer Ownership	58.1	66.3	0.00001	3.7	8.2
Age 8	Wordprocessed Graphics	64.6	70.6	0.001	2.8	6.0
		65.3	70.6	0.010	1.8	5.3
Age 10	Wordprocessed Graphics	65.1	67.8	0.12	-	-
		65.3	69.3	0.038	1.1	4.0
	Internet	65.6	69.1	0.088	-	-

The seeming advantage of family ownership of a computer remains after taking family income and maternal qualification into account, so it is not a proxy for socio-economic resources. It is not clear why it should show more marked associations with literacy than wordprocessing, graphics use, or use of the internet. Perhaps it is because children were unlikely to be using a computer for those purposes until they could read and write, so they have a shorter history of the specific uses which show some associations. Perhaps quite different patterns are occurring within these uses: one child using wordprocessing as a typing machine for something already laboured over by hand, while another is using more of wordprocessing's facilities to edit, including restructure, which involves further reflection on meaning and expression.

Subrahmanyam et al report that home computer use in a U.S. longitudinal study of students from around age 12 to age 17 was associated with higher overall grades, and higher grades in English and mathematics, and that there were also differences within this group, with users for at least 10 hours during the school year on activities which were unrelated to a class doing better than those who used their computer less [this seems quite a low threshold]. They also note gains from computer-based after-school clubs, which is consistent with the early findings of the *Computers in Home* pilot here in New Zealand.

They also note research finding short-term gains for children's visual intelligence from playing computer games, and note the increased use for such skills in science. Moderate game-playing has little negative impact on children's social relations or skills, and can bring more social interaction. The concern that does arise with games is related to "excessive" use (30 hours a week or more), and the playing of violent computer games. They note that "*the amount of aggression and violence has increased with each new generation of games... one survey of seventh and eighth-grade students found that half of their favourite games had violent themes.*" It is not clear from the existing research what impact simulated game playing has, and whether this interactivity is as productive for imagination and understanding as the printed word.

Both Subrahmanyam et al and Wartella & Jennings (2000) in the same volume conclude that research on the relationship of computer use and children's development is only beginning.

CONCLUSION

Three different media, each with particular strengths, and attractions. There is uneven competition between them however for children's time. At present, television does appear to compete with the printed word, but not with the computer. The computer and the printed word do not appear to compete.

Will this change? Television is part of everyday life for almost all families, part of the ongoing background in many homes. The printed word is found in many homes, but not all, and its range may be particularly limited in homes where parents have not gained

qualifications, and are less likely to use reading and writing in their daily lives, particularly if they are in low-skilled jobs. Computers are becoming more common; their use can be more shared than the printed word, depending on what software is used and the purpose of the use. If television screens can be used for computing purposes, perhaps some competition might emerge – or each house will add to the number of screens available to its members.

In terms of literacy in its traditional sense – the ability to make sense of what one reads, and to express oneself and one's understanding in written sequence – television also stands out. It is predominantly visual, it does not call on watchers to express themselves in language (though it may provide grounds for conversation and shared memories). Unlike some computer uses, viewers can access television without vocabulary or alphabet: one does not need to be a confident reader to use a remote control or enjoy television, making it more attractive over time to children whose reading is insecure, work rather than play. Thus it is that we find in our longitudinal exploration that television, *if* taking substantial amounts of time which could be used in ways more supportive of language use, can weaken literacy development.

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