

Exploring the potential of the Homework system and tablet PCs to support continuity of numeracy practices between home and primary school

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Abstract:

We assess whether and how the Homework system was effective in creating greater continuity of understanding between home and school. Children in a year one class (aged 5 years) were taught numeracy using the Homework system on tablet PCs, and they were set activities to carry out on the tablet PC for homework. The Homework system blurs the boundaries between home and school by making learning materials, individual learning histories and information of aims and objectives available in both the school and home context. Six families took part in two semi-structured interviews, pre and post the introduction of the system. Themes that emerged from these data suggest that the Homework system was successful in empowering parents with a new understanding of classroom teaching methods and materials. Overall, children's levels of enthusiasm, confidence, responsibility and independence in numeracy increased significantly in all the households. Moreover, the way in which home and school numeracy activities could be inter-dependant was made more transparent. Thus, homework was seen less as schoolwork to be done at home, but instead as an integral part of a seamless learning experience. The adoption of this approach would be of benefit to schools and may increase the effectiveness of their attempts to engage parents with their children's learning.

INTRODUCTION

The aim of our research was to evaluate whether and how the Homework system was effective in creating greater understanding of numeracy between home and school. There is widespread opinion that portable technologies could be successful in linking home and school by providing "seamless learning spaces" marked by continuity of the learning experience across different scenarios (or environments) (e.g. Chan, Roschelle, Hsi, Kinshuk, Sharples, Brown, Patton, Cherniavsky, Pea, Norris, Soloway, Balacheff, Scardamalia, Dillenbourg, Looi, Milrad and Hoppe 2006 p6) and/or by "being used as containers for carrying instruction between the home and the

school” (Becta 2001 p62). However, we argue that portable technologies alone cannot create effective links between learning environments; the activities that they support and the way these are contextualised are of paramount importance. The challenge is to design and implement a system, for use on portable devices, that successfully bridges the divide between home and school in the understanding and perception of both the role and purpose of homework and the concepts underpinning numeracy and its uses. Here, we describe the extent to which the Homework system, delivered on tablet PCs, achieved this objective over the course of a four-week study.

Many schools have attempted to create links between home and school by using Internet and email to transfer information and homework. Somekh, Mavers and Lewin (2002) suggest that some schools have made some progress in bridging the home-school divide in this way. Portable devices have greater potential, in part because they can be used in a wider variety of physical locations both within and outside the home. Research suggests also that mobile devices can contribute to children experiencing an increased sense of ownership of and responsibility for their learning (e.g. Becta 2004). However, in an overview of twenty-seven schools that provided pupils with laptops, Lewin, Mavers and Somekh (2003) conclude that only six of these schools felt that the initiative had been successful in promoting better home-school links. These authors conclude that children are often unaware of how to make the best use of technology across the home and school settings.

Kerawalla and Crook (2002) explored the differences between the Key Stage 2 (7-11 year olds) classroom and the home environment that can be difficult to overcome when parents buy a home computer to support their child’s learning. In the classroom, teaching and learning are timetabled and structured and there is an emphasis on assessment. At school, computer software is provided with the view of supporting teaching and learning of the National Curriculum and computers are located in learning spaces. Kerawalla et al (2002) report that the general consensus amongst parents is that informal learning at home should be child-initiated and fun because home is primarily a place for relaxation and leisure. As a consequence, use of educational software at home is usually child initiated, minimal and unsupervised, hence children spend more time playing entertainment games (Kerawalla and Crook 2005). However, these authors report that homework is conceptualised differently from other forms of learning in the home. It has a certain authority as it is initiated and set by a teacher and (usually) is not optional. Homework was generally encouraged and supervised within the families in this study, even by those parents who disagreed with it in principle.

In the current study, we wanted to address the fact that homework is conceptualised often as ‘schoolwork that is done at home’, and where school-related materials, teaching methods and values are understood little by parents. Our aim was to make the link between learning at home and school transparent by fostering a greater understanding of their mutual relevance and continuity. We wanted to create an environment in which learning materials were carried from school to home, and vice versa, willingly and enthusiastically. We were less concerned with building a bridge between two separate places and more concerned with blurring the boundaries so that learning became a continuous experience.

For the Homework system, we chose to use tablet PCs as they are sufficiently mobile, capable of running multimedia, relatively easy to use, and robust enough for the

everyday knocks that were to be expected from our evaluation group of 5-6 year olds. Also, these Tablet PCs were equipped with both a stylus and detachable keyboard, giving children a choice of input devices, especially useful for those children who find typing difficult (e.g. Twining et al 2005). The Homework system not only enables the physical transfer of learning materials between contexts, on the tablet PC, it also highlights to children and parents the way in which homework activities are linked to those carried out in the classroom. It achieves this first by making all learning materials available for use in both contexts; homework activities use the same set of software as used in the classroom so the activities are familiar to the child, consistent and the link is explicit. Secondly, weekly learning aims, objectives and keywords are made available to parents to enable them to understand how and why homework activities are related to class work. Parents are provided also with a history of the topics that should have been covered up to the current point in time, so that if a child is absent from school, parents can access the material and go through it with their child at home. These features were designed to promote parental and child understanding of the relevance of homework and to help parents to understand the importance of their role and how it could facilitate both home and school learning.

Our approach is informed by socio-cultural theory which proposes that learning is both mediated by and distributed across the whole learning context; both at school and at home (e.g. Cole 1996, Wertsch 1991 and Vygotsky 1979). If we are to be able to create and assess the provision of “seamless learning spaces” (Chan et al. 2006) we need to adopt a perspective that focuses on individuals-using-technology-in-settings (Crook 1994) as the unit of both concern and analysis. This theoretical stance prioritises the social nature of learning and focuses not only on the technology but also on the context and the people that use it.

In this paper we report the findings from two sets of interviews with six families whose children were part of a class provided with tablet PCs running the Homework system.

METHODOLOGY

Our aim was to assess whether and how the Homework system (delivered on Tablet PCs) became successfully integrated into domestic ecology and was effective in creating greater continuity in numeracy practices between home and school. We wanted to gather opinions from parents so we decided to utilise semi-structured interviews. This enabled us to generate a schedule that we could deliver to all parents whilst also giving them, and the researcher, an opportunity to expand upon other points of interest as they arose.

Participants

All 29 children and their teacher, in a combined year 1 and year 2 class (5-6 years old) at a rural village primary school in Sussex were loaned a tablet PC running the Homework system for 4 weeks. The whole class was taught numeracy using this technology and were set homework to be carried out on their tablet PCs.

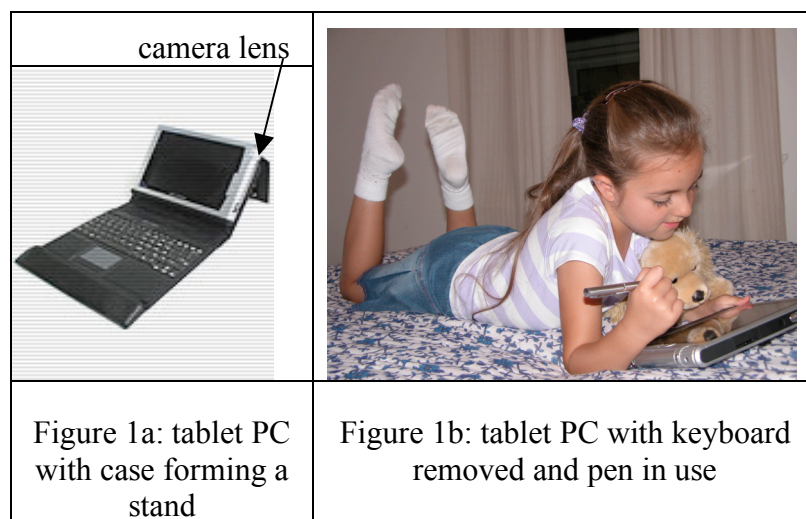
The Homework system

Development of the Homework system was a proof-of-concept project developed in collaboration with Open Mind Productions and Channel 4 Learning. The programmed components were semi-functional at the time of this study. Briefly, the Homework system:

- Holds a database/learner model containing information about each child's significant characteristics, domain skill level etc.
- Enables teachers to develop and deliver individualised learning plans and homework, including digital resources (e.g. multimedia games, video clips, and digital worksheets), to each child or group of children both in class and at home.
- Maintains personal learning histories for each child, which are available to teacher, child and parents, thus facilitating the sharing of knowledge about the child's learning between teachers and home carers.
- Makes information about the aims, objectives and keywords of each week available to children and parents so that they can be aware of exactly what the child is learning each week.
- Enables children to transport all learning materials, their learning histories and homework between home and school, thus making the link between home and classroom activities explicit.
- Enables collection of digital homework to the teacher's tablet PC

Activities were chosen in consultation with the teacher and followed her plan of work. All content was pre-loaded on the children's and teacher's tablet PC. Access to the content was controlled through the child's user interface which was updated regularly. Each child's learning history was a demonstration screen only.

Each child was loaned an ECS V300 tablet PC which was packaged in a case that could be opened to form a stand (see Figure 1a). It also contained a built-in digital camera, a detachable keyboard and an input stylus. This meant it could be used in a variety of locations such as sitting at a table, on a bed (see figure 1b) or on a child's lap.



We designed an interface that automatically launched on start-up, thus hiding the operating system (see interface within bold borders in Figure 2). From here, the children and parents could navigate to various further resources (as indicated by the arrows in figure 2):

- ‘This week for home’. This screen displayed links to each homework activity. Those in Figure 2 are an interactive Number Crew game, a worksheet and an activity that we designed asking the children to identify, describe and photograph arrays in their home. All activities supported what the children had been doing in class. Parents and children could also navigate to a feedback screen where they could type or write (with the pen) comments to the teacher. Lastly, there were links to Journal (which supports hand-writing recognition and drawing) and to two games (Microsoft’s Ink Ball and Minesweeper) for recreational use.
- ‘This week for school’. This screen provided information about the numeracy aims, objectives and keywords and activities for the week. These were all tied to the National Curriculum.
- ‘My History’. This screen provided a demonstration of the summaries that might be useful to parents and teachers, e.g. scores on the Number Crew activities and a record of attendance.

Access to other features of Windows XP and to the internet was disabled so as to minimise errors and the need for technical assistance by these young children.

Parents were invited to attend an introductory session at the school, and were given a demonstration of the Homework system and of the tablet PC. They then tried it themselves and asked questions. The children were introduced to the system in the classroom. Initially, they took a tablet PC home for a one night trial and completed some activities. Parents were given notebooks for their feedback and suggestions. The technology was positively received. Several weeks later, the tablets were reissued for the study period.

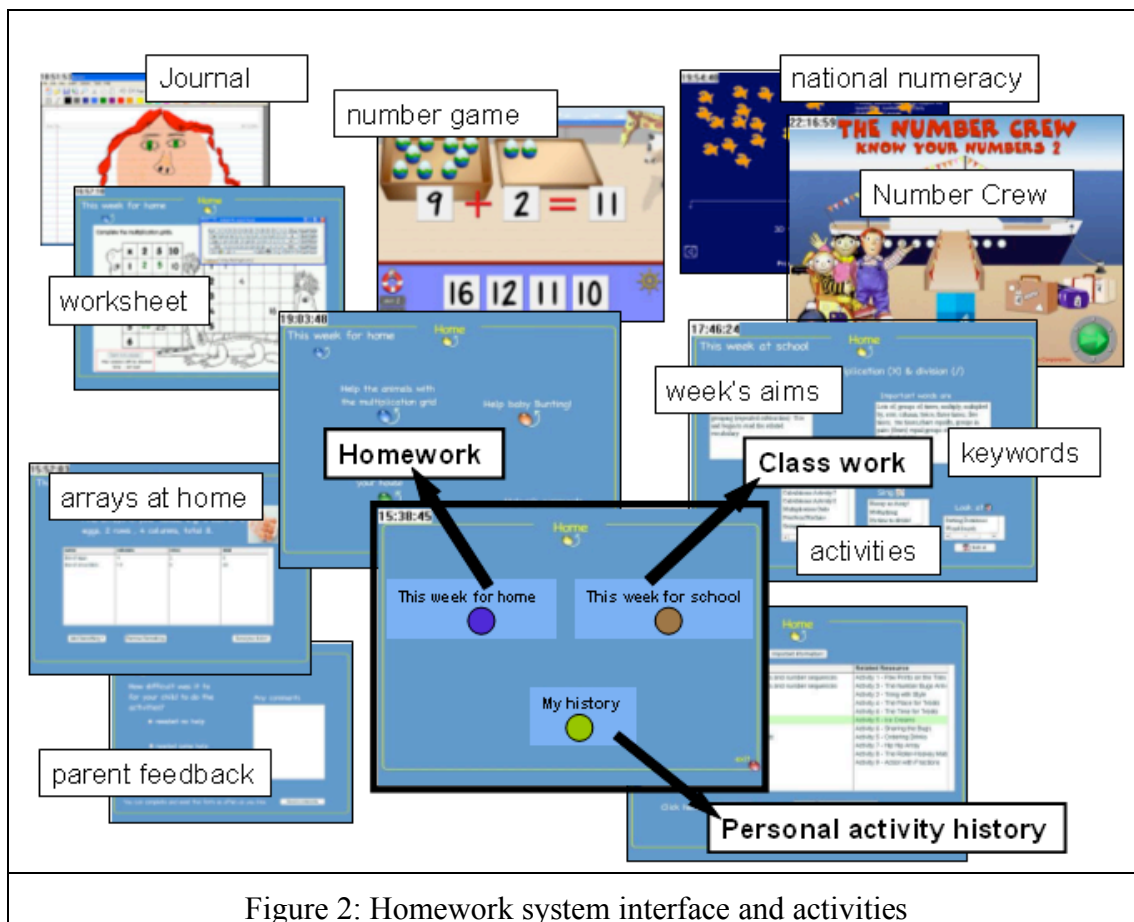


Figure 2: Homework system interface and activities

Data collection and analysis

Parents were invited to participate in two interviews in the home; one before the tablet PCs were distributed and one after their child had been using the tablet PC for 3-4 weeks. Six sets of parents were randomly selected from the respondents and all participated in both interviews. All interviews were digitally audio-recorded.

One of the aims of the first interview was to test and validate the design of the user interface. The interviews were resourced by a storyboard scenario which included a mock Homework system interface that was presented using PowerPoint on a tablet PC. For example, parents were asked to imagine their child coming home from school with their PC and accessing their history. They were shown a mock-up of a 'history' screen and asked to comment on its utility. Each PowerPoint slide was accompanied by a set of questions which all parents were asked and they were given the opportunity to expand upon them as appropriate.

The second interview was based on a set of verbal questions alone and took place after the children had been using a tablet PC for 3 or 4 weeks. Both interviews visited the same core themes (see Figure 3), with the second interview following-up any changes or developments since the first.

Table 1: Home interview core themes	
1. Current amount, type, level of homework and where and when it is carried out.	9. Confidence and enthusiasm for the technology.
2. Levels and sources of help.	10. Confidence with and enthusiasm for numeracy and numeracy homework
3. Opinions about homework	11. Portability of tablet PC and transportation to and from school
4. Nature of informal numeracy activities engaged in at home	12. Using the tablet PC beyond the home.
5. Current links between home and school and opinions of these.	13. Technological problems/issues
6. Awareness of what child is doing in class.	14. Comparisons with ‘traditional’ paper-based homework.
7. Usefulness of the provision of tablet PC-based history and weekly objectives.	15. Family use of tablet PC
8. Opinions of digital camera activities.	16. Use of the home PC

The interviews were transcribed and analysed in Word by the identification of emergent themes. The themes reflected the interview issues (e.g. ‘location of use’). Each collection of utterances within each theme were then further scrutinised and sub-categorised as appropriate (e.g. ‘at home’, ‘out of home’). Representative quotes were extracted carefully to illustrate main points.

FINDINGS

We present our findings in two main sections: the first focuses on how the Homework system contributed to changing pre-existing home-school links, and the second reports on changes in the families’ homework practices and attitudes. It should be borne in mind that no sections exist in isolation from the others; they form a complex web of the inter-related features of domestic life that shaped how the Homework system was adopted.

Linking home and school practices

In this section we will consider whether and how the Homework system was effective in promoting a better understanding of how school work and homework are continuous, mutually beneficial activities.

Pre-existing home-school links

The school worked hard to build links with parents and sent them regular newsletters as well as designing most homework to be collaborative. In spite of this, the overwhelming message from all parents we interviewed was that they wanted more information about what their child was doing at school. One mother said, “*I didn’t know he used the internet, until we saw his school report*”. Parents said that they did not like to “*bother*” the teacher with questions outside of the “*rushed*” biannual parent-teacher interviews. Most parents commented that pre-existing home-school activities were rather “*one sided*” or “*one-way traffic*” that often focussed on parents supporting the school rather than vice versa.

Parents’ use of information about ‘this week at school’

Three families made little or no use of information about classroom activities. Two referred to it if their child asked specifically for assistance. One mother said: “*I just had a look to see what topics they were doing at school, and seeing how it related to*

their homework...I didn't do anything with it...he hasn't had a problem". These parents were happy to be relatively uninvolved with homework on a day-to-day basis. The third family made minimal use of the resource as their high level of help with homework meant they were well acquainted with the material.

The remaining three families were keen to be more closely involved and said they found the details of classroom aims, objectives and key words useful. One parent said it was *"fantastic, absolutely fantastic. It's so much better than having a termly newsletter ... it's so much more up to date and current – it's fantastic"*. Another mother explained how this information helped her to realise that homework was closely linked to classroom activities: *"I didn't really make the link that they were specifically learning this and it was followed up by homework, I felt maybe it was a bit more haphazard"*. These families found the information useful because it enabled them to support their child by having *"the same agenda"* and being more aware of the language used to teach numeracy: *"I didn't know what an array was! I was amazed that they were using that language with him and he knew what it was"*. This meant that parents felt more able to offer support.

However, in spite of some parent's enthusiasm to be involved, four families reported that their child actually needed much less help than usual, with children often being completely independent. The new software activities were designed for a single user, which meant that many children were able to carry them out independently. One mother also suggested that the close link between classroom activities and homework was important in developing her child's independence: *"We do still have to help her with it, but she can find her way through it... and it's the close link with what goes on in the classroom and then what goes on at home which I think is part of that"*. Only one mother expressed regret about her diminishing role: *"There's definitely been a noticeable fall-off in my help ...I've found I was just sitting there while he worked his way through it I did feel out of it I must say"*.

Information on class activities can therefore overcome the problem of parents feeling ill-informed. One mother described how it can *"empower you as a parent"*. The single-user design of the activities, as well as the closer link between homework and class work, meant that some children were able to complete the activities independently.

Use of classroom information to resource informal learning

Perhaps the most encouraging finding was that three families told us that they had an increased understanding of the importance of numeracy, and an increased enthusiasm for exploring ways to expand their child's numeracy experiences beyond formal classroom and homework activities. One father described how he had discovered how to use the distribution of pocket money to reinforce the week's numeracy aims:

*"I've got a lot better understanding of what level they are operating at, and the theme of what they're looking at, which you can then try to back up...If you're giving them their pocket money...**things that just happen and that you do**...instead of giving them a fifty pence, or something, then you can give them five tens and you can back up and reinforce that message. That was a good bit of communication"*.

Another father also explained how he watched the Number Crew videos and used his new understanding of an addition strategy to support his child:

“I was saying to her, ‘right if you had 3 and you wanted to add 8, how many would it be?’ and she was stuck on it. I said, ‘right, well try 8 and then add 3 – do it the other way round,’ and she got one really easily – and that’s what they were doing in class. There is no way I’d have had a clue prior to having it in [the Number Crew video on the tablet]”.

These examples indicate some of the added benefits of an increased parental awareness of what children are doing in school and how they are being taught, beyond immediate help with homework.

Digital camera homework

The children also carried out some homework that involved using a digital camera that was built into the tablet PC. The aims of this were to increase understanding that numeracy permeates the home as well as the classroom, and to demonstrate how learning in each context can be mutually beneficial. One activity involved taking pictures of arrays (e.g. an egg box) in the home, to support teaching about arrays in the classroom.

All of the families said that they enjoyed this homework. Two parents said it made numeracy more “real world” than “staring at a two dimensional sheet [of paper]”. Using the camera was more physical and involved “discovering new things”, in the home which “makes it personal to you” and “you feel like you’ve discovered it yourself.. so you can actually see how [numeracy] relates to everyday objects around you”. One mother described how this activity had made her child more aware of numeracy in his surroundings so that when he noticed an array whilst eating his breakfast he said “There’s another array! – Get that computer out!”. This is a good example of how practices in the home and school support each other and also one child’s mother discovered what an array was by being involved in his homework.

Most children needed parental help using the camera and two parents said they were pleased that their child had gained this experience. One said it was “quite a powerful thing to be able to do”. Two parents described how this activity encouraged them to be involved with their child: “for each item we found and photographed, we talked about it”.

These responses suggest that the digital camera activities gave some parents an opportunity to implement their new understanding of what their children were doing in their class. It also increased their awareness of how numeracy was relevant to both daily life and school, thus increasing opportunities for seamless learning.

Family homework practices and attitudes

Here we will consider whether and how introduction of the Homework system led to any changes in family homework practices and attitudes over the course of this study.

Location of homework

Parents reported that, prior to the introduction of the Homework system, paper-based homework was quite formalised: it was carried-out sitting at a table and that surrounding noise was minimised. Three children had their own desk specifically for homework.

In contrast, tablet-based homework was carried out in a variety of locations within and outside the home (e.g. bedroom, lounge, car or grandma's house). Some children tried to use the tablet in their garden but found that bright sun obscured the screen. This enthusiasm to take it out of the home was not shared by all parents: one was concerned about security and another said that they were worried that its use did not distract from other family activities: *"taking it to the swimming pool...might not be top of your list of things to take with you, especially as we're meant to be watching [her brother] swimming!"* In this example, it appears that it is not so much the location that was a problem, but what else was happening there.

It is interesting that parents did not report any conflicting use of space within their homes, even though children used their tablet PC in areas not usually designated for learning, suggesting that the Homework system was well integrated into the fabric of family life. The parents provided several possible explanations for the increase in the use of other rooms in the home for homework: 1) portability of the technology; 2) the self-contained nature of the activities; 3) that Number Crew homework was more fun (see below) and less formal (see below) than traditional worksheets; 4) that the children could carry out the activities independently (see below) so did not need to be in a space with an adult. Therefore, homework activities became part of broader family life. This was accompanied by a reported increase in the amount of time spent on numeracy per week, which we consider next.

Time spent on homework

Prior to this study, the children received one numeracy homework worksheet per week and most parents spent twenty minutes to one hour helping. All parents reported a dramatic increase in the amount of time spent on numeracy per week following the introduction of the Homework system. One mother said that *"the time compared to normal homework has increased ten fold...it's hugely more at the moment"*. One parent commented that it was too much (because her child was not strong in numeracy so it took up a lot of her time), whilst three others mentioned specifically that they wanted more homework. The increase in time spent on numeracy per week was primarily because all children wanted to do more than just what had been set for homework: *"he certainly spends more time using [the Homework system]. [Previously] he'd just do his written homework then go off and do something else"*.

This increase in time spent on numeracy meant that children were using extra periods that they would not usually have considered, such as before school or at weekends. Three parents said that their child was going to bed later in order to spend extra time using the tablet PC. One parent said that, *"much more time has been spent on numeracy than would have happened before, so the other homework in some ways has been squeezed into a bit of a corner"*. All of these parents were concerned that they would try and readdress the balance if the Homework system became a permanent feature.

Next, we will consider how the reported increase in time spent on homework was probably linked to an increase in children's enthusiasm for, and confidence in, numeracy and use of the technology.

Children's enthusiasm and confidence in numeracy and tablet PC technology

Three sets of parents said that their child's enthusiasm for numeracy had significantly improved. They measured increases in enthusiasm by their child's eagerness to do their homework, the increased amount of time spent on it, their enjoyment (e.g. singing the songs), an eagerness to explore independently, and a reluctance to stop. It is likely to be a combination of the novel technology, the engaging activities and a new understanding of the relevance of homework that the Homework system enabled, that were responsible for this increased enthusiasm

All of the families said that their child enjoyed their new numeracy homework more than completing paper worksheets. Two sets of parents thought that this was just because *"it was a different way of doing it"*, whereas the other four parents were more enthusiastic about what the Number Crew software offered over and above paper worksheets, which were described as *"boring"*, *"flat"*, *"a chore"*, *"a waste of time"* and *"abstract"*. They often described the new homework as offering more choice and more fun: *"of course this is more exciting – there's more colours, there's sound, you can sing if you want to"*. One father explained how his daughter's confidence and willingness had grown:

"She absolutely enjoys it now. I was [previously] teaching her how to add double figures, so 12 + 12 in the past we wouldn't have got past 12 pieces of pasta and 12 pieces of something and counted them altogether. Because she's got more confident, I actually showed her how to write 12 with 12 underneath it and then added down long ways, and she's taken that on board, and she did it herself a few times. Yes, and she wanted to do it, and there was no resistance".

Other parents also spoke of how their child no longer needed to be prompted: *"he'll get on with it without being asked. He asks 'can I do my homework on my computer?' He's very keen to use it"*. This was in contrast to paper-based homework where parents reported that most children had to be reminded and encouraged.

All of the children also became more confident using the technology itself. Many parents were impressed by their child's new skills. One said, *"absolutely phenomenal, gone from a zero skills base to being able to wind it up and close it down, use the mouse pad, everything – unassisted. Outstanding, incredible considering [his age]"*, and another said, *"I think his computer skills have gone completely mad"*. A further three parents said they thought their child had come to know more than they did themselves, and one mother said she now felt unable to help her child because her skill level was comparatively low.

These findings suggest that the Homework activities engendered a new level of enthusiasm and confidence in the children's numeracy and PC skills, which parents were happy with. These changes also contributed to the way in which numeracy became a more pervasive feature of family life: it was carried out more often and more enthusiastically by all the children.

Sibling involvement with the Homework system

Five of the children from the interviewed families had siblings and all were keen to take part in homework activities (only one child was prevented from having a go “*in case she messed things up*”). The type of involvement depended on the sibling’s age, with an older brother helping to take photographs or overseeing a Number Crew game, or a four-year-old joining-in by watching some videos. One set of parents were very pleased that their child’s younger sister had been inspired to carry out her own homework after watching her older sister doing hers: “*that was a defining moment. That’s really encouraging in terms of a positive attitude towards doing work after school and stuff, that was great, you know homework is fun, cool.*”

Three families said there had been sibling rivalry and arguments, especially when the technology was first brought home from school: “*they actually came to blows over his older brother trying to sort of edge his way into using the keyboard*”. Some children within these families often resisted their siblings’ attempts to share the tablet PC, and some parents reported that their own offers of help were often resisted by their child. It seems that children had developed a strong sense of ownership for the technology and a strong sense of personal responsibility for the homework, which the next section explores in more detail.

Children’s ownership of the technology

Each child was given a labelled bag in which to transport their tablet PC to and from school and they were invited to personalise it by decorating their name labels. Four sets of parents said that this activity gave the children an initial sense of ownership. For example, one said, “*there’s nothing quite like having your own things is there, ...with your name in big letters on it, it’s definitely yours then isn’t it?*” Some of the children were also very proud, especially as no other classes at their school were involved: “*it made him feel more important, and he was quite proud of that. When he came out [of school] carrying it he was so chuffed having it*”. Another child resisted his mother’s attempts to help carry it home: “*although he whinged about carrying it, I don’t think he ever gave it to me to carry, whereas the schoolbags might get dumped on me, lunchbox get dumped on me...he felt quite possessive over it*”.

This sense of ownership and pride strengthened over the study period. One father said that, “*she has real ownership over her homework. It’s for her to achieve, as oppose to the written homework where we have to teach it through. That’s hers and she understands it*”. This new independence often led to some children actively resisting help or ‘interference’ from their parents and one mother described how her daughter got “*almost a little bit irritated if we tried to butt in with how we thought it should be.*” Some parents could not gain access to the Homework system until their child had gone to bed.

A further unexpected contribution to the children’s sense of ownership and responsibility was the increased visibility of homework. One mother described how previously “*the [homework] bags are packed [by the teacher] so [my child] is probably not aware when the homework is set, so it’s up to us [parents] to go through the bag*”. However, in contrast, “*she knows that bringing [the tablet PC] home means there’s work to be done on it*”. These findings probably contributed to the fact that most children no longer needed reminding and encouraging to do their homework.

DISCUSSION

We have illustrated how the Homework system, installed on portable Tablet PCs, has been an effective intervention in improving continuity in numeracy learning across school and home contexts. We suggest that the key to the success of the Homework system has been in ensuring that the right information and the right resources have been together at the right time in the right place and in a way that is relevant to the particular viewer. It makes learning materials, individual learning histories and information of aims and objectives available in both the school and home context. Some parents reported that they had gained a better understanding of the methods used to teach numeracy and were able to adopt these for use at home. Others related how it fostered an increased understanding of the relevance of homework and of how they could make a positive contribution to their child's understanding of numeracy in the home. Overall, levels of enthusiasm, confidence, responsibility and independence in numeracy increased significantly in all the households. Moreover, the way in which home and school numeracy activities are inter-dependant and supportive of each other was made transparent. In this way, homework was seen less as schoolwork to be done at home, but instead as an integral part of a seamless learning experience.

The previously reported limited success of home PCs (e.g. Kerawalla and Crook 2002) and laptops (e.g. Lewin, Mavers and Somekh 2003) and the relative success of the Homework system in supporting formal education, suggests that technology, both static and portable, needs to be part of a broader infrastructure of information and support. It is ineffective for parents to buy educational software for their child, or for a school to place details of the curriculum on their website, for example, without schools being involved in helping children and parents to become aware of its relevance and to want and need to access it. Findings from the current study suggest that the following points can contribute to determining whether any technology will be used effectively to make the cohesion of home-school learning more explicit:

1. Using the technology to do what it is good at and which cannot easily be achieved without it (e.g. transfer of detailed, timely information; construction of learning histories; listing of weekly objectives; delivery of interactive games).
2. Ensuring that the activities to be carried out across contexts are transparently relevant to each other and clearly advantageous to the child's education from the perspective of the teacher, the child and their parent/s (e.g. using the same software, meeting the same objectives, expanding and building upon each other).
3. Providing parents with classroom materials and information about classroom aims, objectives and keywords:
 - at a level that they can understand,
 - that they can easily access and actively use if they choose to become involved with their child's learning,
 - that helps them to understand how homework, and their help with it, is relevant to, supportive of, or expands upon class work
 - that can help them to realise opportunities for spontaneous, informal learning opportunities at home
4. Making the activities fun (use of narrative games, songs, camera etc).

All parents reported that they felt positive about the provision of classroom information, which was summed-up by one mother who said it “*empower[s] you as a parent*”. The current study has provided a useful insight into how different parents used this information, which appeared to be shaped by the level of ‘help’ that they thought was appropriate to give their child. Some parents reported that they accessed information about aims, objectives and keywords infrequently, only when their child specifically asked for help, whereas others took a more pro-active approach by making a conscious effort to become more aware of classroom activities. This latter group of parents were also more involved in utilising informal day-to-day learning activities, such as the distribution of pocket money, to reinforce classroom activities. It appears that this new sense of parental agency made a significant contribution to overcoming the previously perceived problem of links between home and school as being “one-way traffic”. Parents were empowered to take action on their own terms; they were given an opportunity to make informed choices.

The Homework system became well integrated into the homes and lives of these families, as indicated by the amount of use, the range of places in which the technology was used and the enthusiasm for using it. This contrasts sharply with reports of previous research into the use of home desktop PCs and laptops as tools to link home and school. This research has made a valuable contribution to our understanding of the importance of maintaining a human-centred focus whilst designing “seamless learning spaces” (Chan et al 2006) so that the activities that the technology supports and the way that they are contextualised are central considerations. The adoption of this approach would be of benefit to schools and may increase the effectiveness of their attempts to engage parents with their children’s learning.

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