Children’s perceptions about writing with their teacher and the StoryStation learning environment

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This paper explores children’s attitudes and opinions about their experiences of writing stories in class, and with the StoryStation writing environment (Robertson and Wiemer-Hastings, 2002). Drawing on evidence from questionnaire and focus group data from a field study of sixty 10–12 year old pupils, it examines how children compare their interactions with an intelligent tutoring system to learning with the teacher. While the children appreciated the benefits of working with StoryStation, it is clear that the use of such interactive learning environments must be carefully integrated with existing classroom practice.

1. Introduction

There has been a recent interest in developing interactive learning environments to assist children with creative tasks, such as story making or drama (Robertson, 2001; Robertson and Oberlander, 2002; Praida et al., 2002; Brna, et al., 2001; Benford et al., 2000; Cassell and Ryokai, 1999). There can be many advantages to supporting imaginative storymaking activities through computing technology including increased motivation, development of collaboration skills and improvements in some aspects of writing (Robertson, 2001). However, working with an interactive learning environment is merely one experience on a spectrum of learning situations that children may encounter. This paper concurs with Buckingham’s position (1999) that learning software cannot replace, nor should it be seen as in competition with, teaching. If the student’s perspective is made central, what emerges about their understanding of their relationship to teachers and to computer software? How can they integrate the learning strategies they use with software with the strategies required of them in other classroom situations? In what ways can interactive learning environments be used to enhance the support provided by teachers?

In using computer software to learn about writing stories, there are many other stories that come into play, stories that form the relational world of the school. These stories are about the school routine, about relations to teachers, relations with peers. Increasingly computer and information technology feature in these stories, having a symbolic value as well as practical use. If software is to help children compose stories that meet the formal criteria of the curriculum, these informal stories and the relational information configured within them need to be taken into consideration by software designers. The stories this paper concerns exist at different levels, the formal level of composed stories, and the informal embedded level of lived stories.

This paper explores these issues in the context of the StoryStation writing environment (Robertson and Wiemer-Hastings, 2002). Evidence is drawn from questionnaires and
interviews with pupils who took part in a recent StoryStation field study. Section 2 describes how writing instruction is approached within the normal classroom setting in British schools, and the relationship between the teacher and pupils in this arrangement. It refers to some previous computer writing environments, and studies which highlight the ways in which learners interact with interactive learning environments. Section 3 briefly describes the StoryStation software, followed by a description of the field study in Section 4. The data from the field study is reported and interpreted in Section 5. Lastly, Section 6 contains some further reflections on the issue of children’s attitudes to writing with teachers and computers.

2. Background

In order to evaluate the impact of the StoryStation writing environment on pupils, it is necessary to describe the normal classroom writing instruction which pupils are likely to encounter, and the sort of relationship they may have with their teacher while they are learning to write. It is also of interest to study previous research into relationships between learners and interactive learning environments.

Writing in schools

Teaching pupils how to express their thoughts, ideas and feelings in writing is considered to be of central importance in the Scottish curriculum, and much effort has been devoted to improving national literacy standards. Graves’ process approach to writing (Graves, 1983) has been influential in the development of the Scottish curriculum guidelines (Ellis and Friel, 1998). The process approach is a holistic method of teaching writing, centred on the idea that children are keen to express themselves. The approach specifies that children should write regularly and frequently, they should decide that they want to write, they should draft and redraft their work, they should discuss it with their teacher and other class members, and eventually they should have an opportunity to publish it. The teacher’s role is to model good writing practice and to offer advice and assistance when the pupil needs it. The children should have control of the writing in order to foster a sense of ownership and pride in their writing. This in turn will increase their motivation to write.

StoryStation was developed for use in Scottish schools and is therefore tailored to the guidelines of the Scottish Curriculum. However, the goals and methods used in Scotland are relevant to other education systems, as they are informed by Graves’ (1983) well known process approach to writing. The Scottish Council for Research in Education specifies a three stage writing process which teachers should adopt (SCRE, 1995): preparing for writing; drafting and redrafting; and preparing for publishing. In the phase of preparing for writing, the teacher’s task is to help the pupils generate ideas for their writing and to plan how these ideas will unfold in their writing. She will also ensure that the children are aware of the style of language appropriate to genre, both by supplying them with examples of writing in a variety of genres, and by leading class discussions about language devices they could use when writing in these genres. The suggested genres include functional, personal and imaginative writing, and encompass sub genres such as newspaper reports, instruction booklets, diaries, letters, stories and poems. During the drafting and redrafting stage, the pupils use a plan to write first and subsequent drafts. The pupil amends and adds to her drafts based on her own evaluation of her work and feedback from the teacher and other pupils. At the publishing phase, the teacher helps the pupil to ensure that surface features of the writing such as spelling, handwriting and layout are suitable.

At the time of writing, there were insufficient computing facilities available in Scottish schools for pupils to use a word processor for all stages of the writing process. Pupils are most likely to use a word processor at the publishing stage of the writing process, after the teacher has provided feedback on a draft. In contrast, StoryStation is designed to be used as a tool throughout all stages of the writing process. The resource requirements of StoryStation are likely to be met in the near future by a new IT equipment policy in schools which will provide banks of laptops computers which classes can book for certain lessons.
Relationship between the writing teacher and her pupils

A fundamental part aspect of Graves’ process approach to writing is the pupil-teacher writing conference, in which a pupil and teacher discuss the pupil’s writing and find strategies for improving it. Pupil-teacher conferencing is a particular tactic used to develop children’s writing skills by eliciting their own assessment of their work. Underpinned, particularly in Britain (Alexander, 2000) by a Piagetian model of child development, this private conversation is supposed to level the power relations between teacher and pupil and allow the pupil to take the lead in exploring his or her own developing criteria for good writing skills.

This conference is likely to be held in a public setting, either at the teacher’s desk or at the pupil’s seat within a group of other children. Writing conferences are infrequent, perhaps every two weeks, as the teacher must spend time with all her pupils. Pupils may also receive written comments on a draft a day or so after they hand it in to be marked. There are also limited opportunities for pupils to coach each other on their writing by offering constructive criticism on early drafts. Naturally, the quality of this feedback is dependent on the peer’s ability to detect mistakes and offer appropriate corrections for them. The pupils occasionally use a computer to word process their stories.

It is important to note some of these relationships are more observable and therefore more reportable than others. Crucially for this study the pupils’ relationship to the computer has a capacity for privacy that other interactions at school do not. What the pupil does at the keyboard becomes observable by others for the most part only as she chooses to report it or present it. This, of course, is not the case for tasks students are assigned to do on the computer as a group. In contrast, during pupil-teacher or peer conferences other class members can overhear potentially embarrassing criticism or praise.

Discourse analysis of classroom talk suggests that a key component of pupil-teacher conferencing about work in progress runs into difficulties achieving its stated intentions (Young, 1992; Alexander, 2000; Chouliaraki, 1998). Analysis of actual teacher student conversations reveals that there are often more disciplinary or directive exchanges than discursive, learning content exchanges. Rather than concentrating on the topic of the writing, or the mechanics of writing, most of the interaction is more general and behaviour oriented, i.e. “work harder”. In attempting to withhold specific comments about the text in order to give room for the pupil to make those comments, the teacher’s remarks come across as vague or as generally behaviour- oriented. Often this is due to time constraints, which compress what a teacher might hope to convey into shorthand versions.

Chouliaraki (1998) contends that a tacit assumption upon which teacher discourse is based may contribute to children’s difficulties interpreting teacher advice, that premise being that the teacher helps students take responsibility for their own writing, by allowing them to find the mistakes or areas that need improvement for themselves. By withholding specific criticism and asking reflective questions about the text as a whole or making general comments the teacher leaves room for the student to think and decide for themselves how to interpret this advice and change their text. However, it appears that children do not interpret these oblique directions as helping them to “think for themselves”, but rather as vague or even frustrating. Previous research has noted that pupils may have difficulty interpreting teachers’ written comments in their exercise books, and may be at a loss on how to act on such vague advice (Dunsbee and Ford, 1982; Coupe, 1986).

The relationships between pupils and interactive learning environments

Researchers in the field of artificial intelligence in education have explored the patterns of interaction between learners and intelligent tutoring systems in order to understand the ways in which learners interact with machine, rather than human, teachers.

An example of a recent learning environment which was specifically designed to be emotionally supportive for its users, and to mimic empathic relationships between
teacher and pupils is T’riffic Tales (Cooper and Brna, 2001). The design of this system was informed by theories of empathic interactions between class teachers and their pupils. It is a cartoon creation program designed for five year olds who are learning to write. Pupils can ask for help with their stories from an emotional pedagogical agent named Louisa. The designers take the view that a pedagogical agent should provide emotional support - care, concern continuity, and security - for learners as well as cognitive, domain related support. They propose a cycle of behaviours for such an agent which signals to the pupil that help is available, provides help in an engaging, interactive manner, and assures the pupil that further help is available if needed (Brna, Cooper and Rasmerita, 2001).

Another approach to the design of intelligent tutoring systems to which learners can relate is to try to understand users’ experiences of using prototype systems, and the reasons why they choose to accept or reject help. Hammerton and Luckin, (1999) describe a series of studies which use an adaptation of a Wizard of Oz technique to discover young users’ beliefs about assistance from an intelligent tutoring system designed to teach ecology. The findings of such studies are useful for the design of future tutoring systems and for highlighting learners’ underlying attitudes to the capabilities of learning technology.

One reason why it is important to establish learners’ attitudes towards intelligent tutoring systems relates to the “plausibility problem” (Lepper, Woolverton, Mumme and Gurtnner, 1993). Even if an intelligent tutoring system was able to diagnose the learners’ cognitive and motivational states and provide appropriate feedback to the same standard as a human teacher, there is the potential problem that the system’s advice would not be as effective as a human tutor’s simply because it is delivered by a machine. That is, there may be some behaviors which learners would find unacceptable or implausible when exhibited by a machine, which would be acceptable when exhibited by a teacher. Would learners accept the evasive tactics used by teachers to encourage independent thinking in their pupils when used by an intelligent tutoring system? Or would they object to a mere machine withholding information from them? Du Boulay, Luckin and del Soldato (1999) cite examples of user comments about tutoring systems where the user appears disgruntled by system’s attempt to use teacher-like strategies of withholding hints. It is also possible that certain types of users might find teaching behaviour more acceptable when exhibited by a machine than when displayed by the teacher. For users who value privacy while they learn, it might be more acceptable to read criticisms from a computer screen than to have them read aloud by a teacher within earshot of peers.

Du Boulay, Luckin and del Soldato (1999) argue that users’ senses of what is acceptable behaviour from a machine is restricted by their limited experience with learning software. Currently, school pupils are unlikely to have had an opportunity to use an intelligent tutoring system, so their expectations of the availability and quality of the advice offered by such a system will be based on “some mixture of computer games and CAL programs as well as on science fiction” (du Boulay, Luckin, and del Soldato, 1999, p.231). Prior experience of CAL (Computer Assisted Learning) programs may cause users to underestimate the quality of help on offer in a tutoring system and spurn offers of assistance from it (an explanation of the results reported in Luckin and Du Boulay, 1999 suggested in du Boulay, Luckin, and del Soldato, 1999). On the other hand, preconceptions about the capabilities of a tutoring system based on science fiction scenarios may mislead the user into expecting far more of the system than it can feasibly offer. This issue is further complicated by the current trend towards animated
pedagogical agents in intelligent tutoring systems (Johnson et al., 2000). These characters are generally employed to make the interface more motivating to the user and to broaden the bandwidth of communication between the user and machine. Indeed, there is some evidence to suggest that users of learning environments with agent interfaces have more positive attitudes toward the system, and make more learning gains than users of equivalent systems without agent interfaces (Moreno, Mayer and Lester, 2001; Robertson, Cross, McLeod and Wiemer-Hastings, to appear). Such interfaces deliberately anthropomorphise the machine by giving the persona of a character thus presenting cues which may lead a student to overestimate the intelligence of the system. For example, young users of intelligent tutoring systems which use Microsoft agent characters such as Einstein or Merlin the Magician on the interface might potentially attribute the wisdom of the character’s persona to the system. This “personification problem” is likely to be more of an issue with lower ability learners who lack the cognitive facilities to identify when the quality of advice offered by the system does not match quality suggested by the animated agents.

In addition to qualitative research into users’ attitudes towards seeking help from an intelligent tutoring system, there has also been interest in quantitative analysis of users’ help seeking behaviour using log file statistics generated by the tutoring system (Luckin and Du Boulay, 1999; Wood and Wood, 1999; Aleven and Koedinger, 1999). Analysis of similar qualitative help seeking data collected during the StoryStation study is underway and will be reported elsewhere. The focus of this paper is on StoryStation users’ attitudes to the system, their perceptions of it in comparison to their teachers, and their ideas about the animated agents in StoryStation.

3. StoryStation

A screen shot of the agent version of StoryStation is shown in Figure 1. The program was designed in conjunction with a team of two teachers and eight children from a state funded primary school (Robertson, 2002). The children in the design team created and animated the agents for the software. The teachers provided expert knowledge of the Scottish National Curriculum and experience in the problems of teaching writing. StoryStation has also been evaluated with 18 teachers who were extremely positive about the system, particularly with respect to its potential for developing independent learning skills.

StoryStation is an intelligent tutoring system designed to give children feedback on a range of storywriting skills, including spelling, vocabulary usage, and character descriptions. It also provides tools to help with the composition process, such as a dictionary, a thesaurus and banks of words relating to particular topics.

The assessment features are intended to be used during the editing process to draw the pupils’ attention to parts of the text where they have successfully used a writing technique. The philosophy behind this is to encourage pupils to take responsibility for their own learning by helping them to identify their own strengths and weaknesses. It is also intended to raise self esteem by praising pupils when they have used language techniques well.

A writing technique which is often encouraged by teachers is making a story more interesting by using descriptive or unfamiliar vocabulary – “using good words” in classroom shorthand. StoryStation uses frequency information from the British National Corpus to identify word in the story which occur relatively infrequently in the English language. This information is used in conjunction with word frequency statistics derived
from a corpus of children’s stories and the ability level of the user to decide which words should be highlighted as examples of good vocabulary. Use of descriptive phrases is also detected using a part of speech tagger.

Another writing technique which is valued by teachers is describing the characters in a story. Pupils are asked to write descriptions of the characters’ appearance and personality, to portray how the characters feel and to write in-character dialogue. StoryStation uses a word spotting approach to identify words which are related to appearance, personality, feelings and dialogue based on an analysis scheme described in Robertson (2001). The program compares words in the story to word lists populated with vocabulary associated with the characterisation categories in the analysis scheme. It tailors feedback on these techniques to the user’s ability level, and highlights the parts of the story where characterisation techniques have been used.

A very important part of story writing is presenting the plot in a coherent way. A facility for detecting incoherent plots is under development, but was not used in the study reported here. The approach taken so far is to combine statistical natural language processing techniques such as latent semantic analysis with knowledge of narrative schemas to detect when a story has deviated from an expected plot structure. This approach will be of use for constrained tasks, such as story re-writing, when the system has structural knowledge of the story which the pupil is attempting to write. This activity is commonly used in classrooms when the teacher wants to separate the creative task of imagining a story plot from the linguistic task of representing the plot in a written form. However, automated detection of incoherence in free-form writing is likely to be a more complex problem and requires more development. Further details of the StoryStation technology can be found in (Robertson and Wiemer-Hastings, 2002)

The system’s advice is given to pupils on request – it does not provide unsolicited feedback. The user selects the type of help she requires by clicking on one of the buttons (see Figure 1). An area of future research is to develop heuristics for deciding when to offer help to pupils, taking into account their ability level, their current progress, the stage in the writing process and possibly their motivational state. In one version of StoryStation, help and feedback is presented via eight different animated pedagogical agents, one for each skill supported by StoryStation. As a main goal of the StoryStation project is to research whether animated pedagogical agents have an impact on users’ attitude or behaviour towards a system, there is also a version of StoryStation which presents exactly the same advice without animated agents. Exploration of some issues relating to children’s perceptions of the animated agents can be found in the section “Children’s perceptions of StoryStation agents”. For a full discussion of previous research work in animated agents and a quantitative comparison of pupils’ attitudes to the agent and non-agent versions of StoryStation, see Roberston, Cross, MacLeod and Wiemer-Hastings (to appear).

Pictures of the animated agents can be seen on the buttons in Figure 1. The agents were designed and animated by pupils in the design team. Each agent was created by a different pupil and allocated to a function according to the pupils’ choice. No attempt was made to match the function to the appearance of the agent, as the functions are too abstract to map neatly to pictorial representations. Each of the agents has a “show” animation which is played when the agent first appears in screen, and an unobtrusive “idle” animation such as blinking. The agents which represent assessment features also have different animations which are played alongside positive and negative feedback from StoryStation. These are intended to convey pleasure or mild displeasure (it is
important that the agents do not offend the pupils when they make mistakes). The children also selected voices for their agents by selecting accents, gender and pitch in the Microsoft Agent Character Editor.

4. Field Study

Context

The field study reported in this study took place in a state-funded primary school in the suburbs of Edinburgh during a ten-day period in May 2002. Sixty pupils ten to twelve year olds took part in the study from 3 classes. In setting the scene for the study, it is also important to describe what kind of culture or ethos predominated in the school in which research was conducted. As Alexander (2000) has pointed out, the kinds of priorities that shape the overall school day significantly shape how children can respond in that setting. This particular primary school enjoys a good reputation in the city and attracts families with considerable investment and interest in their children’s education. Bernstein’s (1975) characterisation of advantaged schools as emphasising concept-oriented education holds true in this instance. There was ample evidence that students are encouraged to think about how they learn, as well as what they learn, and to take steps to become independent, and self-confident and self-directed learners. The open-plan structure of the building itself necessitated children taking a more active role in focusing their attention. Children’s awareness of this school’s ethos was embedded within the remarks they made about their normal school day, the routine stories they alluded to in discussing how StoryStation might fit in with the rest of their school experience.

It is useful to report the children’s prior computing experience at home, as it may have influenced their interpretations of the StoryStation experience, and may give insight into their likely expectations about the capabilities of the system. All but one of the pupils said they used the computer at home. The most popular use mentioned was for e-mailing or sending instant messages to friends. Gaming and drawing were also mentioned. The diversity emerged when students described family interaction with the computer. Some children talked about their parents’ use of computers at home and their parents’ engagement with them on computer activities; others lamented the fact that their use of the computer was limited because younger siblings learning games took up
hard disc space and user time. Some students reported that their younger siblings were using the computer more, playing learning games on it, than they had, indicating just how swiftly generations of technology are changing.

It also needs to be stressed that their in-school computer use experiences were relatively limited in comparison with their home use. Normally children were not allowed to compose at the computer screen. They first wrote out an assignment by hand, and only then after it had been assessed by the teacher were they then allowed to copy it into printed text on the computer, depending on if there was both time in their school schedule and availability of computers. The pupils used Microsoft Word to write their stories both at home and in class.

**Method**

Thirty-three of the pupils used an agent version of StoryStation, and twenty-seven used a version, which gave exactly the same advice, presented without animated agents. All pupils used StoryStation to write a story called “The Screaming Skulls of Calgarth”, based on a recording of the researcher telling a version of the legend (Finlay and Hancock, 1976). Time on task varied from 35 minutes to 70 minutes, due to constraints in the school timetable. This is unfortunate from the point of view of the experimental design but such problems can be difficult to avoid in a field study in a busy school.

All pupils completed a visual analogue scale to assess their attitudes to StoryStation, before taking part in small focus group discussions. Due to timetabling difficulties in the school, different groups of pupils were interviewed for different lengths of time (ranging from 15 to 30 minutes). The interview questions were also varied to fit in with the impetus of children’s comments (Mishler 1986).

**Data Collection**

Two instruments were used to collect data. For a qualitative assessment of the users’ attitudes towards StoryStation, a visual analogue scale was used. The scale was carefully developed to ensure no confusing negations were used, and that the vocabulary was appropriate to the target age group. It was piloted on a group of eight pupils at a different school to filter out questions which the pupils might have difficulty interpreting. The extreme “no” value on the scale is at 0 cm; the extreme “yes” value is at 8.3 cm. The statements on the visual analogue scale were as follows:

1. I enjoyed using StoryStation
2. I think StoryStation made my writing worse
3. I think I would like to use StoryStation again
4. Using StoryStation helped me to write better
5. I found StoryStation confusing
6. StoryStation makes writing stories easier
7. I think I need someone to help me use StoryStation
8. I think the StoryStation advice was useful
9. A teacher is more helpful than StoryStation
10. StoryStation is boring

After filling the visual analogue scale, the pupils took part in a focus group discussion with three other peers who used StoryStation in the same session. The focus group consisted of some structured questions, more exploratory open questions tailored to fit in with responses children were giving and discussion starter prompts. Thus a variety of approaches were used to uncover underlying attitudes towards animated agents, and
relationships between pupils, teachers and technology. The variety of approaches meant children had more options to express themselves and meant that one form of response could help contextualise or ‘triangulate’ their other responses. Questions on which this paper focuses asked the children to compare StoryStation with classroom writing instruction in order to establish whether the children could identify strengths and weaknesses of the system. During discussions, the pupils were asked a series of questions designed to help them compare their teacher’s story writing advice with StoryStation advice. The questions were “In what ways is writing with StoryStation different from writing in the classroom?”, “What kinds of things does the teacher do to help you with your writing?”, “Are things that StoryStation helped you with which your teacher doesn’t normally?” , “Are there things StoryStation can do which your teacher couldn’t do?” , “Are there things you think StoryStation couldn’t do which your teacher can?” , “Do you think you’d be more likely to change your story according to StoryStation’s advice than a teacher’s advice?”, “Would you be more likely to trust advice from StoryStation or from a teacher?”. The last question was designed to gauge the children’s faith in the advice offered by a computer. It was phrased emotively on purpose to discover the children’s feelings towards working with a computer.

The pupils were asked a subset of these questions, depending on the answers they gave, and the interpretations they gave as part of their answers. In addition, the pupils who used a version of the system with the animated agents were asked some questions about what they thought of the agents. They were asked which were their favourite and least favourite questions, which of them were least and most helpful, which of them were least and most intelligent. In addition, a series of questions which were intended to explore the pupils’ understandings of the agents were asked: “Would the program work without the helpers?”, “Do you think the helpers made the program better?”, “Where do you think the helpers come from?”, “What do you think happens to them when the computer is switched off?”. The focus group discussions were recorded with the participants’ permission and transcribed. Children’s responses were coded and compared across discussion groups using an interactional sociolinguistic framework (Rampton, 2001). Care was taken to pay attention not only what was said, but the contextual factors of the conversation that influenced the responses. Examples of such contextual factors are: was the comment volunteered or prompted by a question?; was it offered in agreement or disagreement with either the interviewer or the other participants in the group?

5. **Children’s comparisons of StoryStation to their teacher**

Evidence of children’s comparisons of StoryStation to their teacher comes from two main sources: quantitative data from a visual analogue scale, and qualitative analysis of focus group questions. These findings are presented and interpreted below.

**Quantitative data from a visual analogue scale**

Results of the questionnaire question which was designed to measure the pupils’ attitudes towards StoryStation and their teachers are below. The questions analysed below is most pertinent to the present topic. A full analysis of this data, and a breakdown of users’ attitudes by agent and non-agent version are reported in Robertson, Cross, McLeod and Wiemer-Hastings (to appear).

The mean value for the statement “A teacher is more helpful than StoryStation” is 2.429 (Standard deviation = 2.271). That is, the pupils did not believe that a teacher is more helpful than StoryStation. It was observed that the pupils filled in this question quickly, without hesitation. This shows that pupils find
StoryStation at least as helpful as their teacher, regardless of whether the advice is presented by agents or not. Evidence from the interviews confirms the interpretation that pupils value StoryStation’s advice as highly as their teachers’, rather than the interpretation that they value neither.

### 4.2 Qualitative data from focus group discussions

**Comparison of StoryStation and the teacher**

The pupils reported that their teacher provided help in a variety of ways including: spelling, “key words” (similar to the StoryStation word banks), thinking of good vocabulary, advice on how to describe the characters, and planning out the story plot. In fact, with the exception of the plot advice, the teachers offered the same sort of services as StoryStation. However, none of the pupils reported that their teacher helped them with all of the skills supported by StoryStation.

The children gave many practical reasons for preferring to write with StoryStation. They appreciated having a collection of help facilities in the same place. For example, they frequently mentioned that it was useful to have the dictionary and thesaurus easily accessible so that they did not have to interrupt their flow of ideas to go and fetch a dictionary from the shelf. The teachers also commented on this point, noting that it made for a quieter classroom with fewer disruptions from pupils moving around the classroom.

The pupils also appreciated that StoryStation could give them advice whenever they wanted it, and that it could “go through every word with them”. One group of interviewees explained that there was almost always a queue for the teacher’s help in the classroom and that sometimes they would forget what they wanted to ask by the time they got to the head of the queue. This was frustrating to them so they enjoyed the luxury of getting help as soon as they needed it in StoryStation. (“You don’t have to wait fifteen minutes for some service”). As stated in the previous section, the philosophy of the school is that teachers strategically encourage their pupils to take responsibility for their own learning, for example, by insisting that they look up words they cannot spell in the dictionary. It emerges from the interview data that some children struggle to make sense of this child centred pedagogy. Several times in the course of the StoryStation interviews children emphasised the time constraint aspect of their interaction with their teacher and this sense of the teacher’s advice being general in contrast to the more specific and immediately pertinent response from StoryStation.

One group of pupils who appeared to benefit particularly from StoryStation were average ability boys. The reasons for this seem to be related to their relationships with their teachers. Older boys in particular, seemed to prefer the computer’s advice to their teachers, particularly the fact that this transaction is basically conducted in private, between just them and the agents on screen, rather than being a public performance in front of the whole class, as exchanges with teachers inevitably are. One 12 year old boy commented “StoryStation is better because you don’t get embarrassed if you forget. [In class] you have to go up and ask again. So you keep on asking if you forget and sometimes the teacher shouts at you if you get something wrong.” When questioned further, the pupil revealed that if the StoryStation agents shouted at him, he would “tell them to shut up”. This demonstrates that although StoryStation was seen to have high status as a writing expert, it was not necessarily considered to have high social status. With reference to the plausibility problem described in Section 2, it suggests that certain user groups would not accept negatively framed criticism from the tutoring system.
The fear of “being shouted at” was mentioned by other older boys. Jackson’s (2002) work on “laddishness” as a self-protection and image-damage limitation strategy details just why boys may welcome the opportunity to get on with work out of the spotlight. Her work suggests that what attracts the censure of male peers is not academic success in and of itself but the appearance of trying to succeed. StoryStation may provide boys who have concerns about being seen to try the opportunity to try with a reduced risk of being seen to try. With StoryStation any requests for help or correction do not involve the very visible walk up to the teacher’s desk to do so. It is helpful, here to refer to the relationship diagram presented earlier. StoryStation gives boys the opportunity to transfer one the relationship lines from a public one to a private one. A younger girl also commented that the “teacher comes and peers at you”, suggesting that there are times when a teacher’s unsolicited help can be an invasion of privacy. This has implications for the design of agent interactions, throwing some light on the issue of whether agents should provide unsolicited help.

During the StoryStation study, the researcher worked one to one with children assessed at the lowest curriculum level on the grounds that this service was normally provided by a classroom assistant. It was observed that these pupils were particularly motivated by positive StoryStation advice, but needed the support of an adult to help them to make the suggested improvements to the story. For example, a girl who was praised by Jim and Eye-Eye (two of the StoryStation agents) was completely delighted, but needed further explanation and demonstration of how to modify her story in response to their comments. It seems that there are benefits in using StoryStation for less able writers, but that the help and support of a teacher are still required, particularly with respect to the issue of the accuracy of the system’s advice, as discussed below.

The graph in Figure 2 illustrates the proportions of response categories to the question “Would you be more likely to trust advice from StoryStation or from a teacher?” It can be seen that the most frequent response was StoryStation. Given the evidence from studies of help seeking behaviour (Wood and Wood, 1999; Aleven and Koedinger, 1999) which suggest that learners are often not aware of their own learning needs, this graph can only be interpreted with reference to the pupils’ reasons for their beliefs.

The pupils supported their opinions with a range of reasons. Reasons for trusting the teacher more were related to the teacher’s depth of knowledge of the subject, for example “The teacher can explain things to you”, “There is a bit more to the teacher’s advice” and “The teacher knows what your writing is meant to be about, but StoryStation doesn’t”. Some pupils also commented that the teacher would know them
and their writing better because “she has just marked our national tests”. Some of the girls cited interpersonal reasons for preferring the teacher, such as “the teacher can look into your eyes and tell what you are thinking” or “I can talk to her and she understands”.

Reasons for trusting the advice from StoryStation were related to the perceived expertise of the computer; either because the computer itself was seen as an expert, or because the software contained the knowledge of several experts.

Some of the children had an unfortunate tendency to regard a computer as infallible, saying “It’s a computer and computers don’t make mistakes”. These attitudes give cause for concern, particularly when they are voiced by children of lower writing ability. The following comments all came from children in the lowest curriculum level for writing. “[I’d trust] Story Station because it’s a computer, it been built, it’s cleverer than the teacher.”; “Well the teacher’s advice doesn’t always have to be true but StoryStation you know [it’s right] because it was put there by an expert”; “[StoryStation agents say] that’s well done, that’s good and then you know that it’s right and no one is going to mark it wrong.” It is not necessarily true that children with lower writing ability are more gullible and inclined to blindly trust the computer. The point is that lower ability writers are less able to discern whether writing advice is helpful or accurate. When the writer also believes that the computer is “always right”, she is at risk of being misled by incorrect advice from the tutoring system. In such cases, the teacher is necessary to help the pupil interpret the system’s advice.

However, some pupils gave more sophisticated explanations of why they would trust StoryStation’s advice more. One boy pointed out that “Lots of teachers put advice into StoryStation”, others commented that there was lots of good advice in StoryStation which was put there by “lots of teachers and engineers”. The assumption that the program gives good advice because it is an expert system is reasonable, and it is interesting in the context of the pupils’ normal audience for their stories. Normally, the teacher is the main audience and single expert critic of children’s stories. The opportunity to receive constructive criticism and praise from other experts, albeit mediated through a computer program, may be appealing to more able writers. The possibility that the program might not be a faithful representation of the experts’ knowledge was raised: “Computers make mistakes. If there is something wrong with the program it could be giving you the wrong advice. With a teacher you can discuss it, but you can’t with StoryStation”. Perhaps this pupil would appreciate an open student model, and the opportunity to negotiate its contents, as described in (Dimitrova et al, 2002).

A few pupils were cautious about comparing the teacher with StoryStation, saying that they both give good advice. One boy sensibly decided to wait and see what StoryStation’s advice was like over several sessions before committing himself.

Children’s perceptions of StoryStation agents

An aim of the focus group sessions was to discover the users’ attitudes towards the agents, and gain some insight into how the conceptualised these characters.

The pupils were first asked which were their favourite and least favourite of the characters. They were also asked which were the most and least helpful of the agents. The purpose of these questions was to discover whether the pupils favoured agents which they considered to be helpful, or whether they had other reasons for liking them. There was no clear favourite or least favourite agent. The distribution of answers and the children’s explanations for them indicate that preference for an agent is related to either personal preference for the character’s appearance (“I like the way he looks”, “He is drawn best”) or the usefulness of the agent to the pupil (“I used him most and he helped me with my character descriptions”, “I forgot the story but he reminded me”).
The agent which helps with spelling was considered to be the most helpful agent, while ironically, the overall help agent was considered to be least helpful. Other helpful characters were the characterisation agent, and the vocabulary agent. The purpose of the overall help agent was to provide interface and story writing tips to the users, and because they were given a demo of the system and a clearly defined task, few of the pupils needed this sort of general assistance. The pupils did not tend to elaborate on their reasons for finding Whiskers most helpful beyond “because he helps you with spelling”. The fact that spelling was one of the most frequently requested features by pupils during the requirements gathering phase of StoryStation’s development, suggests that the users found this character most helpful because he provided assistance with an aspect of writing they recognised to be difficult and error prone.

The pupils were also asked some questions intended to discover how they thought about the agents. It is interesting to explore the pupils’ understanding of the animated characters, particularly if advice presented by agents has some bearing on the “plausibility problem” described in Section 2. If users believe that the agents have personas, one might expect that they would be more likely to accept teacher-like advice from them, than from a normal user interface. The pupils were asked “would the program work without the helpers?”, and “do you think the helpers made the program better?” in order to establish whether they thought that the program would function in the absence of the agents, or whether the agents had to be there with the program so that they could offer advice. The pupils tended to interpret the questions as “do you think the interface agents make the program more fun?”, so their answers were not pertinent to their conceptualisations of the agents. Their answers included comments such as “It wouldn’t be as fun. It would be kind of like for adults” and “It wouldn’t work without them because they’re the ones that talk to you”.

The questions “where do you think the helpers come from?” and “what do you think happens to them when the computer is switched off?” were slightly more successful at uncovering the pupils’ beliefs about the agents. There were four main categories of response: confusion, imaginative responses, pragmatic responses and computational explanations. The most common responses were generally pragmatic – “you put them there”, “someone drew them”, “someone typed in the words [for word bank character] that’s how he helps you so much”. The second most common sort of response was confusion, characterised by embarrassed silence and evasion of eye contact with the researcher. It is unclear what caused this reaction – possibly this question confronted the children’s theories of mind in such a challenging way that they did not know how to interpret the question. It is also possible that the pupils were embarrassed that the otherwise sensible seeming researchers were asking such bizarre questions. This interpretation is reinforced by the researchers’ impressions that some of the pupils’ imaginative responses about agents were intended to humour them. For example, one girl said “When you turn off the computer they all go back to the university to a little house thing” with a facial expression which suggested that she was spinning a story to keep the adults amused. Other imaginative responses were “When the computer is switched off they go to sleep and they’ve got bedrooms and they sit and think up new words to tell you” and “they’re aliens”. It is worth remembering that children’s imaginative answers to adults’ questions are often praised, and that the pupils may have interpreted the question as a request for a story or funny idea. Only one boy attempted a computational explanation of how computers work “Well inside the computer it’s just yes and no. The helper program translates it into words that we would know”.

Although formulated with some care to avoid leading the pupils, the questions used to uncover the pupils’ beliefs about the agents gave answers which are difficult to interpret. It is hard to tell from their responses whether they believe that the helpers are intentional agents in their own right, although it seems that the pupils who gave pragmatic responses did not believe that the agents had “personhood”. It is also difficult to find an appropriate interviewing method to ask difficult questions of this sort without the risk of making the children feel exposed. When interviewed in groups, the child who really believes that agents are real cannot admit this to a group of sceptical peers without losing face. On the other hand, one to one interviews cause difficulties if the pupil is shy and doesn’t feel comfortable talking candidly to a relatively unfamiliar adult. More research is required to find a suitable methodology for discovering children’s beliefs about agents in the field of intelligent tutoring systems, as this issue is important when considering the plausibility problem about what teaching behaviour users find acceptable from an intelligent tutoring system.

6. Further reflections

Observation and discussions with pupils and teachers during the StoryStation project consistently showed that the pupils who took part in this study viewed the StoryStation technology as a useful resource to help them with their writing. They noted that
StoryStation could provide them with help when they needed it, in contrast to the classroom situation where they often have to wait for some time before receiving help from a teacher. There is evidence that they appreciated the direct and specific advice about how to improve their stories, possibly because they find it difficult to act on non-specific encouragement from their teachers. Overall children’s responses suggest StoryStation improves the flow of work and concentration on tasks whilst providing them a safe arena for feedback that can have positive effects on pupils’ confidence and motivation.

Can the more targeted help that StoryStation provides with the mechanics of the story free up time for teachers to engage in higher-order discussions with pupils? For this to happen teachers would need support re-examining their own conversations with pupils as well as the automated conversations that occur between StoryStation characters and pupils.

Although the pupils may be relieved by StoryStation’s assessment and advice on specific aspects of writing, it is clearly in their best interests to help them to develop successful strategies for diagnosing and repairing problems with their own writing. From this perspective, StoryStation’s advice can be seen as a starting point for a dialogue between teacher and pupil. The pupil would have the advantage of the specific, categorized feedback from StoryStation, with the benefits of explanation, clarification and insight from the teacher. This compromise is of particular importance to lower ability children, who may find it hard to carry out StoryStation’s suggestions, and who may not be able to spot when StoryStation’s advice is inappropriate. Further research is required to establish the most effective ways in which teachers could use StoryStation as a template for helping pupils’ independent thinking, for example by using the StoryStation agents as examples of behaviour they can internalise.

A further study working more closely with a smaller number of students and a teacher in which they could use the program over a period of time to write a series of stories could usefully illuminate more about how relationships with teacher and with computer agents can effect student’s independent learning skills, particularly story editing. It is also necessary to investigate how the pupils’ motivation to use StoryStation changes over time, as there may be a novelty effect at work here. Furthermore, it is necessary to investigate the effectiveness of StoryStation in a variety of schools with pupils from a range of socio-economic backgrounds. In particular, the study reported here took place in a middle class school where all pupils had regular access to computing equipment in school, and the vast majority used computers at home. It is probable that these pupils’ experiences with StoryStation were shaped by their experience with other software applications. Indeed, the interview data shows that their interactions with the software agents were shaped by encounters with previous such agents. How would the attitudes of children who have relatively little computer experience differ? How can teachers help such pupils interpret their interactions with intelligent, personified tutoring systems?

Children’s interaction with computer technology is quite diverse. Their understanding of the possibilities of computer and their possibilities as learners are intricately wedded to their prior computing experience, experience out of school playing a large role in determining their stance towards computers. If there is a digital divide (Atwell 2001) that has to do not so much with availability of equipment but to do with the sophistication of its use, how can StoryStation help bridge that divide?
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8. **References**


Young, R. 1992 Critical Theory and Classroom Talk, Clevedon, Multilingual Matters Ltd.
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