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Multimodal texts: Numeracy development in naturalistic learning contexts

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As part of their leisure many children are spending increasing amounts of time engaged in playing technology-based games. Such games come in a number of forms and use a range of technologies. These require game players to use a variety of different literacies in order to participate in this culture and to interpret the dynamic flow of texts. As part of this process the players engage in ongoing learning opportunities that have their foundations in numeracy understandings. This presentation focuses on the Pokemon phenomena as an example of multimodal text and highlights examples of numeracy learning within this popular culture in naturalistic learning contexts. The case study investigations encouraged children to share their learning about texts that are generally marginalised within the traditional school culture, but that are part of children's everyday experiences. It provided evidence that numeracy learning was established in both deep and authentic ways as the children navigated their way thought the technology-rich environment. This work has important implications for stakeholders who want to support children and their numeracy learning.

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Abstract

As part of their leisure many children are spending increasing amounts of time engaged in playing technology-based games. Such games come in a number of forms and use a range of technologies. These require game players to use a variety of different literacies in order to participate in this culture and to interpret the dynamic flow of texts. As part of this process the players engage in ongoing learning opportunities that have their foundations in numeracy understandings. This presentation focuses on the Pokemon phenomena as an example of multimodal text and highlights examples of numeracy learning within this popular culture in naturalistic learning contexts. The case study investigations encouraged children to share their learning about texts that are generally marginalised within the traditional school culture, but that are part of children's everyday experiences. It provided evidence that numeracy learning was established in both deep and authentic ways as the children navigated their way thought the technology-rich environment. This work has important implications for stakeholders who want to support children and their numeracy learning.

The context of the investigation is positioned within the understanding that meanings are accessed in a range of ways. The work of the New London Group (Cope & Kalantzis, 2002) provides new approaches for considering the ways in which we make meanings from texts that have a strong technological dimension. Such forms of multimodal texts interact with technology-based media in ways that demand the "readers" of these texts move well beyond the traditional notions of literacy. For example, when game players are engaged in activities that require the interpretation of text across a range of text forms they are faced with the need to activate highly sophisticated literacy and numeracy skills. The skills include the ability to interpret texts using multiple designs of meaning including visual and spatial designs. Such thinking is strongly supported by Kress, who believes that:

> the rapidly increasing use of visual modes of communication has a complex set of causes, the simultaneous development and the exponential expansion of potentials of the electronic technologies will entrench visual modes of communication as a rival to language in many domains of public life. (Kress, 1997, p. 55)

Because there is a reluctance within school contexts to accept the validity of such forms of texts as valid sites for learning, this study required the researchers to work within naturalistic settings. This ensured an authenticity of social context that could only be achieved in this realistic environment.

Several authors (including Snyder, 1997; Burniske, 2000) have argued that multimodal texts are an integral part of today's society. These are the kinds of everyday texts that are part of daily life for children outside the school context. They include such formats as cartoons, music video clips, and computer games. The increasingly high visual nature of these texts has ensured that visual literacies (Kress, 1995) are becoming increasingly important to all aspect of literacy development. Moreover, children are being exposed to more and more forms of literacy outside traditional classroom settings. As Beavis (1997, p. 245) suggests "if the sorts of texts students engage with in their out-of-school worlds are becoming more and more technology based, the literacies needed to 'read' them are becoming more sophisticated". Although language is an integral component of negotiating meanings, in these highly visual contexts it is no longer sufficient. It could also be argued that within a muliliteracies framework there are increasingly high demands on numeracy

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skills related to the interpretation of graphic designs and other forms of spatial and visual reasoning. Such an approach enables our thinking to move beyond the traditional emphasis on the written and spoken word for delineating meaning to consider a multiliteracies framework which enables a recognition of increasingly high demands on numeracy skills.

One of the main reservoirs of multimodal texts in contemporary society lies within the domain of popular culture. Such forms of text depend strongly on the use of visual modes rather than simply the linguistic modes of the more traditional forms of texts. Advocates for the recognition of the importance of the visual mode argue that 'the image has taken over the word as the primary source of information, … and that the word has given away to the image as the fundamental process in the representation of the world,' and that 'it is also a dominant mode of interpretation' (Fuery and Masefield, 2000, p.88). Such a view however is not uncontested, and as long ago as 1977, Barthes, while acknowledging that the role of image required thought, also recognised that 'there are those who think that the image is an extremely rudimentary system in comparison with language' (p.32).

As educators, we cannot afford to ignore the role of popular culture texts in children's lives (Giroux, 2001). Children are spending increasing amounts of their leisure time engaged within ICT contexts (Lowrie, 2002), with some of these technology-based experiences directly linked to pop culture texts (Clancy & Lowrie, 2002). It could be argued that *if* pop culture texts were to be considered as serious sites for learning and contestation then classrooms could become more inclusive for all students. Learners would then begin to understand that the learning and literacies they have already acquired outside school contexts are transferable and valued.

Multiliteracies and making mathematical meanings

In recent years, advances in technology have ensured that graphic displays have not only become more "realistic" but also more sophisticated in the demands they place on users (Lowrie, 2002). This requires them to interpret information and construct understandings from the visual displays generated from the computer-based environments in ways previously not recognised and articulated. Such activities result in participants drawing on visual and spatial modes of meaning in order to interpret visual designs and understand spatial context that are evident in these environments. The literacies involved in these processes move well beyond the traditional views of what constitutes literacy and provide solid links with literacies involved in numeracy contexts. Moreover, such forms of imagery play a significant role in the learning of school mathematics (Presmeg, 1985) and as such affect the way in which mathematics is delivered in the future. Consequently, this paper specifically address two modes of meaning that have high numeracy demands and include visual design and spatial reasoning.

To date, most research that has been carried out in this area has concentrated on the mathematics content that students access and adapt to ICT situations in order to solve problems. Generally, this research has been restricted to mathematical understandings associated with 2D and 3D representations. By taking a multiliteracies perspective, the present study takes a broader view of the relationships between numeracy and

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literacy. In this way it becomes evident that far more mathematical learning is being generated than previously acknowledged.

Context of the Study

The participants

This case study forms part of a two-year investigation into the way two boys (now aged 10 and 11) made meaning when engaged with a variety of multimodal texts in naturalistic learning contexts. These texts were directly associated with the Pokemon phenomena and included information books, playing cards, computer games, internet sites and games (for example Game Boy, Pokeball). The boys frequently used all of these forms of multimodal texts and played with one another on a regular basis. The boys formed part of a cultural group where participants regularly engaged in social interactions based around the use of various Pokemon texts. The cultural group also involved a much broader community of children from the two schools they attended.

Data Analysis

This inquiry uses an "instrumental case study" (Stake, 2000) which is a technique that can be used to advance the understanding of an external interest. In this case the participants were chosen because they were able to give the researchers access to the discursive practices of the Pokemon phenomenon and to illuminate their understandings about the numeracies and literacies needed for young players to successfully engage with Pokemon texts. Through using such a case study analysis the researchers have been able to theorise the numeracy and literacy practices of the students, in relation to examples of the complex multimodal texts that are becoming part of their everyday contexts.

Data were collected across two one-hour sessions during which the participants were interviewed as they played the Pokemon game in a naturalistic setting. After each session data were analysed in order to: 1) identify the ways in which the participants used a range of mulliliteracies in order to navigate their way through the game; and 2) monitor the numeracy embedded within the discourse being generated as they played the game. Follow-up sessions were also conducted to clarify the students' ideas and thinking processes and to understand the specific links they were making across other forms of text (for example, the Pokemon handbook or the internet cheat sites).

Research Questions

1. What forms of numeracy understandings are identified when interactions are analysed within a multiliteracies framework?
2. To what extent are the students able to make links between naturalistic experiences associated with numeracy development and its relationship with content usually addressed in school contexts?
3. What opportunities for mathematics-related learning are developed as students engage in ICT-rich contexts that typically occur outside traditional school settings?

Findings

Forms of numeracy understandings identified when interactions are analysed within a multiliteracies framework

Through participating in their gameplay the boys collected information on which to base their decisions about exchanging (trading). To do this they had to develop sound

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understandings of the principles and conditions related to trading within the context of the game and the implications of trading through time. Such knowledge then enabled them to develop quite complex understandings of what constituted 'value' and 'currency' within this environment. In many ways these complex ideas of value and currency were linked to conceptual understandings of proportional reasoning—where the boys were required to make comparisons between different relationships between a variety entities. They explained some of these ideas in the following ways:

> *You can only trade into time if say had the Red version and your were trading in Gold version because when they built the Red version back then they didn't have Gold version but they put a time capsule into the game so that if any one ever invented something like he gold version at a hight level the could still trade between them (Ric).*
>
> *When you trade you get boosted experience. You grow levels faster. (Mark)*
>
> *When you trade you learn more (Ric)*

Understandings of value and currency were also evident in their discussion relating to the role of money within the game. Firstly, they clearly articulated that commodities (useful and valuable things) could be purchased throughout the journey. Although they begin the game with 'two thousand pounds' they were not prepared to buy anything too early in the game as they considered it was not necessary and they preferred to conserve their capital for later needs. It could be argued that such decisions were based on experiences within real-life contexts and thus were relatively authentic in the boys perceptions of being participants in a commercial world.

Secondly, they recognised the need to accumulate additional money as they went along in case they needed to purchase items and they were also competitive in seeing how much money they could have by the end of the game. The way in which the money was accumulated involved quite sophisticated processes of mathematical thinking. For example, as the following transcript demonstrates, they were conceptualising the use of fractions but not using the specific terminology.

> Author: *...and the mother saves money for you?*
> Ric: *Yeah so you don't spend it all*
> Author: *So it's like you get pocket money?*
> Ric: *No you get money from battling*
> Mark: *Every time you win a battle they give you a certain amount of money for wining. Half of their money*
> Author: *Oh I didn't know that, you win money when you battle*
> Ric: *Yeah and you send half of that money t your mum*
> Author: *so that is half of their money and you send half to your mum so you finish up with a quarter.*
> Ric: *Yeah one quarter of that other person's money except mum is saving another quarter*
> [later in the conversation]
> Mark: *If you loose a battle half your money goes to the other person and that's very bad because you have a lot of money.*

Interestingly, this last comment offered by Mark highlighted another form of numeracy that was considered throughout the game playing. Both boys commented

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that it was not fair to loose half your money when you were so far into the journey—since loosing a battle at the beginning of the game may cost you hundreds of pounds while loosing a battle toward the end of the game may result in the loss of millions of pounds. Understandings of probability and chance impacted on the decisions they made and the risks they were prepared to take. They argued that 'it was not fair' to be penalised so much money for constantly improving. Although the boys did not approve of this structure it could be seen as a salient message in relation to real-world corporate failures.

Links between naturalistic experiences associated with numeracy development and its relationship with content usually addressed in school contexts.

Although the handbooks give details in relation to the height and weight (in Imperial measures) of each Pokemon, Mark commented that, 'you don't really use this information'. While acknowledging that size and weight can sometimes be important in deciding the strategy for attack, players tend to rely on the visual shape and size of the pokemon on the screen rather than details provided in the Handbook. Interestingly, he admits, however, that this is much easier to do when using the Nintendo game rather than the Gameboy which lacks graphic detail and clarity. Seemingly ignoring data (in the form of Pokemon profiles) from the Handbook may lead to problematic decision making in a numeracy context, however the boys use other contextual knowledge gained from watching the television show to determine appropriate (those which are likely to succeed) Pokemon for battle. Once again notions of chance and probability emerge from such decision making.

Mathematics-related learning developed as students engage in ICT-rich contexts that typically occur outside traditional school settings

The engagement in ICT-rich contexts required in such game playing moves beyond the sorts of experiences typically presented in the classroom. The interpretation of multiple graphics occurs simultaneously and spontaneously as the players navigate through the game. For example, both the health and experience points are shown through the use of dynamic horizontal bar graphs. The health points also use colour to categorise the different levels.

> Author: *Your health points are going down rapidly, it's red now is that because it is getting low?*
> Ric: *Yes, there is red, orange and green. Green is full and once you go down a bit past half way they go orange.*

This graphical information needs to be considered and reacted to as the players make decisions throughout their journey. These constantly changing graphical displays are dynamic in nature which is in direct contrast to the more static nature of the traditional forms of texts used in classroom contexts. Furthermore, these graphical displays are quite different from the 2D-like representations of bar graphs and maps presented in classroom investigations.

Throughout the entire game the screen is constantly changing and showing multiple pieces of information at the one time. To interpret these and to keep track of where

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they are at in the game players rely constantly on using a range of numeracy thinking skills to access the visual and spatial modes required to make meaning of the games.

Conclusions

The case study structure of this investigation enabled children to share their learning about texts that are generally marginalised within the traditional school culture, but certainly formed a part of children's everyday experiences. These findings provided evidence that numeracy learning was established in both deep and authentic ways as the children navigated their way thought the technology-rich environment of their game experiences. It is worth noting, however, that although the students actively engaged in working with mathematical concepts as they played their games, they were not necessarily using the language of mathematics to justify or explain their reasoning. This may be because they had not made the connections between school mathematics and the type of numeracy required to play or game or in fact because they felt that it was an obvious connection they did not need to articulate with the researchers.

Alternatively, it may be the case that they did not recognise the direct links between their proportional reasoning and the nature of the mathematical activity. For example, the students were able to appreciate that when they received half of "pooled" money for battling half of that went to their mother for safekeeping. Consequently, they were left with a quarter of the original amount. However, they did not seem to make the connection between this proportional understanding and the fact that ½ + ¼ + ¼ equalled the original pooled amount. Interestingly, the actual task was relatively authentic in the sense that it was both rich and meaningfully aligned to their immediate interests. Nevertheless, within this naturalistic setting, the connections between numeracy and school mathematics were not recognised as encompassing similar concepts.

This would suggest that in an educational context there are real avenues for considering the role of explicit teaching using content that is directly relevant and of real interest to the students in order to consolidate mathematical understandings. Moreover, this work has important implications for stakeholders who want to support children and their numeracy learning. It could be argued that the children are not seeing the relevance of school-based mathematical learning in the context of their daily experiences.

Implications

This investigation highlights the need for more attention to be paid to the diversity of texts that students are exposed to and the numeracies and literacies that are required in our digital age. The study recognised the multiple skills that students are developing in the home context, primarily of their own accord, as they engage in activities that they find both meaningful and authentic. It also shows the potential such forms of learning can have on student's numeracy development. It seems to be the case that learning communities like the one described in this study need to be more frequently recognised at school as multimodal communications become increasingly relevant to children's needs and interests. Educators should be encouraged to make closer connections to these forms of learning as a way of promoting the kinds of numeracy understandings that will be required as information and other forms of technological communications are presented across a range of visual and spatial displays.

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