Teaching with Games

Using commercial off-the-shelf computer games in formal education

Richard Sandford, Mary Ulicsak, Keri Facer and Tim Rudd

futurelab

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1 Executive summary

The Teaching with Games project was a one-year study designed to offer a broad overview of teachers' and students' use of and attitudes towards commercial off-the-shelf (COTS) computer games in schools. It aimed to identify the factors that would impact the use of these entertainment games in school and describe the processes by which teachers plan and implement games-based learning in existing curricular contexts. Finally, it aimed to provide recommendations for future games-based learning approaches in schools for teachers, developers and policy makers.

The study had two main activities:

1. National surveys conducted by Ipsos MORI of primary and secondary teachers and school children aged 11-16.

2. Detailed case studies of 10 teachers' approaches to developing their use of games for learning. Ten case studies were completed in four schools. The schools represented a range of urban, rural, state and private settings. Two schools offered lessons based on a competency-based curriculum derived from the RSA's Opening Minds project, in addition to lessons based on a traditional curriculum. The games used in the schools were: The Sims 2, RollerCoaster Tycoon 3 and Knights of Honor.

The key findings from the project were:

- A generational divide in games play is still evident, with a significant majority of teachers (72%) not playing games for leisure, compared with 82% of students playing games outside lessons at least once a fortnight. Boys were also more likely to play games for leisure than girls. The majority of teachers and students surveyed reported that they thought games would motivate students to engage with learning.

- The teachers and students in the case studies generally reported that using games in lessons was motivating. However, the study suggests that student motivation might be more likely to arise 1) when students were using games familiar from their home environment, and 2) when students were able to have some degree of autonomy in playing the game.

Knights Of Honor - Black Sea Games

The Sims 2 - EA

Rollercoaster Tycoon 3 - Atari

- There were a variety of technical obstacles to be overcome when using the games in a school context. These were largely due to the copy-protection features of the games. Technical support staff play a significant role in supporting teachers to overcome these difficulties.

- Concerns over curriculum and assessment appeared to be more influential in selecting the age of students to use games in lessons than the age rating for the games. No teacher expressed concern about using 'teen games', ie those suitable for 13 and over, with 11 year-olds.

- Many teachers found the fixed length of lessons to be constraining in both the planning and implementation of games-based learning in schools.

- There was a range of gaming ability amongst students which had an impact on teachers' lesson plans. In general, there seemed to be an expectation that students would be more competent using the game in class than they were seen to be.

- While teachers needed a certain level of familiarity with a game to be able to use it in their teaching, achieving particular educational objectives through the use of the game was more dependent upon a teacher's knowledge of the curriculum with which they were working than it was on their ability with the game.

- Teachers followed either competence or content-based curricula. Despite initial assumptions, the particular curriculum followed by teachers did not appear to be the primary factor determining success in integrating a game into classroom teaching. Rather, the particular context in which a teacher worked – their experience, their teaching style, their familiarity with the curriculum followed and the wider culture of the institution – appeared to have more impact.

- Using games in a meaningful way within lessons depended far more on the effective use of existing teaching skills than it did on the development of any new, game-related skills. Far from being sidelined, teachers were required to take a central role in scaffolding and supporting students' learning through games.

- Where previous studies have suggested that games need to offer a fully accurate underlying model to be of benefit for formal education, this study suggests that for the game to be of benefit to teachers, it need only be accurate to a certain degree: there may be wider inaccuracies within the game model, but these do not necessarily preclude the game from being used meaningfully in a lesson.

What was clear from the study was that a number of factors were significant in influencing the process by which games can be appropriated for use in schools. These included:

- the technical infrastructure of the school (including personnel and facilities)

- institutional and professional factors (including the organisation of time and space in the school, cultures of collaboration/knowledge sharing, traditions of 'best practice' in lesson planning, and classroom rituals)

- the extent to which games can be 'disaggregated' and appropriated to meet specific needs

- the individual teachers' personal experience of games play, and their personal and professional identities as teachers

- the pervading cultural expectations of children's attitudes to and expertise in playing computer games.

While games may have potential to support learning and while many teachers and pupils expressed enthusiasm in using games in lessons (for example, one teacher said "Oh I'd love to use it again. I think there's so much potential in it"), it is clear that these factors need to be taken into account by teachers, and ideally by school leaders and games developers, before potential can be fully realised.

Teaching with Games trial at Bedminster Down School using RollerCoaster Tycoon 3

2 Introduction

2.1 About this report

Much has been written about the potential of commercial computer games[1] (COTS games) as digital learning tools, and many commentators have drawn attention to aspects of these games that might be useful in learning. These discussions tend to concentrate on the use of games outside formal learning environments and yet, today, there are increasing numbers of educators who are already using these games in their teaching practice[2]. Despite this, little research exists on the factors which influence the use of such games in formal educational settings, the attitudes towards this use held by teachers and students, or the extent to which such games may or may not support the curriculum goals of formal education.

The year-long Teaching with Games project aimed to extend our understanding of the ways in which commercial computer games might be implemented in a formal educational setting, drawing on empirical evidence and examining the real-world use of selected commercial titles in schools.

This report outlines the context, objectives, methods, findings and key messages arising from the project. It is not intended to provide a detailed description of the participating teachers' use of games, nor their success as learning resources, but instead to identify the key themes emerging from the process of developing and trialling new approaches to the use of games in the schools we worked with. Additional materials (including detailed case studies of the participating teachers' teaching and research) will be published on the Futurelab website in autumn 2006.

2.2 Context and objectives

Within the last few years, we have witnessed growing interest in the potential use of COTS games for learning. In the UK, educational policy makers have recently funded the development of commercial games for use in educational settings, and a publication from ELSPA[3], supported by the DfES, on games and education is due in autumn 2006[4]. A key driver for this interest is the often cited view that young people are both increasingly disengaged with education and increasingly motivated and engaged by the digital games culture outside school. Incorporating computer games into learning environments, it is hoped by many, will enhance student engagement with learning.

At the same time, the academic education research community has begun to pay significant attention to the ways in which computer games might support learning. As commentators such as Gee, McFarlane and others have argued[5], computer games themselves might be seen as powerful educational tools. These researchers argue that as computer games are designed 'to be learned',

they can provide models of good learning practices. It is also argued that by playing games young people are developing competencies that are equipping them to work and communicate effectively in the 21st century. Increasingly today, we witness the emergence of new conferences and communities dedicated to the study of 'serious games' and bringing together representatives from research, practice, policy and industry sectors[6].

In comparison with studies of young people's games-based learning outside school, however, there have been only a limited number of studies of the use of COTS games in school. Those studies which do exist have identified this as an area both of potentially significant interest to educators, and of significant challenges. The majority of these studies point to games playing a major role in increasing motivation and engagement with learning, and in supporting the development of collaboration, communication, thinking and ICT skills. These studies also identify a number of challenges in incorporating games into school settings, identifying timetabling and curricular difficulties as specifically constraining in the use of games, and a number of technical issues requiring resolution (such as appropriate mechanisms for saving and restarting games)[7].

The aim of the Teaching with Games project was not to replicate this research, but to build upon and complement these earlier findings. The objectives of this report are to highlight findings from the study in the following areas:

- To offer a broad overview of teachers' and students' use of computer games and attitudes towards computer games in schools.
- To identify key factors which impact upon the incorporation of computer games into existing school practices, including institutional, curricular, technical and cultural issues.
- To describe the processes by which teachers plan and implement games-based learning in existing curricular contexts.

The project did not aim to evaluate the learning impact of the use of COTS games. Given that it was the first time the participating teachers and institutions had used games in this way, it would be misleading to assess the effects of a first implementation. The potential of these games to impact learning in formal education should be considered after the factors identified by the project have been more thoroughly assessed and resolved.

As discussed above, the Teaching with Games study also aims to produce detailed case studies of teachers' implementation of games for learning in schools. In order to keep this report within readable limits, this information is presented separately on the Futurelab website for those teachers and others who would be interested in learning from the activities of the teachers involved in this project.

3 Project overview

The Teaching with Games project consisted of two main strands of activity: first, two surveys of representative samples of students and teachers aimed at eliciting a broad overview of attitudes to and use of computer games for learning; second, case studies of 12 teachers[8] in four secondary schools (supported by Futurelab researchers) who prepared and implemented schemes of work in diverse subject areas using three commercial computer games in formal classroom time.

3.1 Surveys

Futurelab collaborated with Ipsos MORI to undertake two surveys of teachers' and students' attitudes to and use of games.

The Ipsos MORI Teachers' Omnibus questioned a representative sample of 924 primary and secondary school teachers in England[9]. The questions focused on ascertaining teachers' existing use of commercial computer games, any use of such games in the classroom, and their opinions about the impact of using games for learning in school.

The Ipsos MORI Schools Omnibus consisted of 2,334 completed questionnaires in England and Wales[10]. Again the questions focused on students' existing use of commercial computer games outside of school and their attitude towards using them in schools.

3.2 Case studies

3.2.1 Selected games

The three games used by the teachers were selected by Futurelab researchers. The games selected for use were The Sims 2, Knights of Honor and RollerCoaster Tycoon 3. These games are often referred to as 'god games', as the player has control over the entire environment. They were selected against the following criteria[11]:

- the broad appropriateness of the titles for a school
- the learning curve of a title
- the opportunities for players to engage with authentic content and challenges

- the degree of autonomy exercised by the player
- the presence of clear causal relationships between game variables
- the critical reception given to the game on release
- previous academic research on learning with games
- non-duplication of existing school resources (eg spreadsheets).

The chosen games are summarised below.

Game	Age rating	Summary of game
The Sims 2	Teen (13+)[12]	Players direct the journey of their Sims' lives as they grow from infancy through childhood, teenage life and adulthood. Starting with a personality given to them by the player (or inherited from their parents), Sims will develop in unique ways based on the player's choices and influence.
Roller Coaster Tycoon 3 (RCT3)	Everyone[13]	Acting as theme park manager, players control elements with the aim of improving happiness of employers and guests. Interactions between variables (for example, admission prices, ride excitement and provision of facilities) lead to the emergence of complex situations (so, for example, placing a food stall next to a nausea-inducing ride will lead to an increase in vomiting guests and a drop in general happiness).
Knights of Honor (KoH)	12+[13]	The player's aim is to accumulate sufficient political and military influence to be crowned ruler of Europe. This is achieved through arranging marriages to provide heirs, making trade agreements and military pacts with other nations, infiltrating other nations' courts and waging war on enemies.

Table 1
Summary of selected games

3.2.2 Participating schools

Four schools participated in the project. They represented a variety of student intakes and curricula, and represented a diversity of both rural and urban settings, and private and state sectors. The Senior Management Team (SMT) in each school took on the responsibility for identifying teachers and students to participate in the project.

Bedminster Down (BD) is a community comprehensive with approximately 1,000 students located in an urban setting. They follow the National Curriculum for 11-16 year-olds. The overall economic background is broadly average but the educational background was previously deemed broadly within the lowest 10% nationally (Ofsted report 2001[14]). The computer room has a computer for the teacher's use connected to an interactive whiteboard and approximately 16 other computers, sufficient for the students to work in pairs.

Deutsche Schule London (DSL) is a private school with over 650 students from 20 countries aged 3-19. Lessons are held in German. In the morning students predominantly follow the Baden-Württemberg curriculum, with afternoon lessons being less restricted. The one computer room has a computer for the teacher's use connected to an interactive whiteboard, and fixed tables facing the front in a semi-circular format with sufficient other computers for one per student.

John Cabot City Technology College (JC) is a mixed city technology college in an urban setting for 11-18 year-olds, with approximately 1,000 students. The students' average attainment on entry is just above the national average but is wide ranging (Ofsted 2002[15]). All the lessons were held in classrooms using laptops; however, the classrooms each had a computer for the teacher's use connected to an interactive whiteboard.

St Johns Community College (StJ) is a foundation mixed comprehensive with technology and language status for 11-18 year-olds, with approximately 1,500 students. The students come from a variety of rural and urban backgrounds reflecting the area, and the average attainment on entry is just above the national average (Ofsted 2005[16]). The computer room had sufficient computers for each student to work individually and a computer for the teacher's use connected to an interactive whiteboard. The Design and Technology (D&T) lab has 10 desktop computers, but the students worked in groups around two laptops and one desktop.

Competency curricula

St Johns and John Cabot have both adopted a special curriculum for selected school years. St Johns' 'Alternative Curriculum' is followed in Years 7 and 8 (11-13 years old), with a pilot group in Year 9. John Cabot's Year 7 students follow the 'Cabot Competency Curriculum' (CCC)[17]. Both these curricula are adaptations of the RSA's New Curriculum, developed through their Opening Minds[18] initiative. This suggests that a curriculum explicitly designed to develop the skills students need to become independent learners would better meet the needs of young people in the current century than a traditional information-driven curriculum, such as the National Curriculum. These skills and competencies broadly address learning, citizenship, relating to people, managing situations and managing information.

Both St Johns and John Cabot belong to the South West 2 group in the Specialist Schools and Academies Trust[19].

3.2.3 Participating teachers

In each school, the SMT was asked to recommend three teachers to participate in the project. This resulted in a wide variety of teachers in terms of games expertise and subject area; from avid gamers to games novices, from English teachers to D&T teachers. Nine of the participating teachers were male. Table 2 provides a summary of the teachers (including two teachers who subsequently joined the project), the subjects they taught and their gender.

Teaching with Games trial at Bedminster Down School using RollerCoaster Tycoon 3

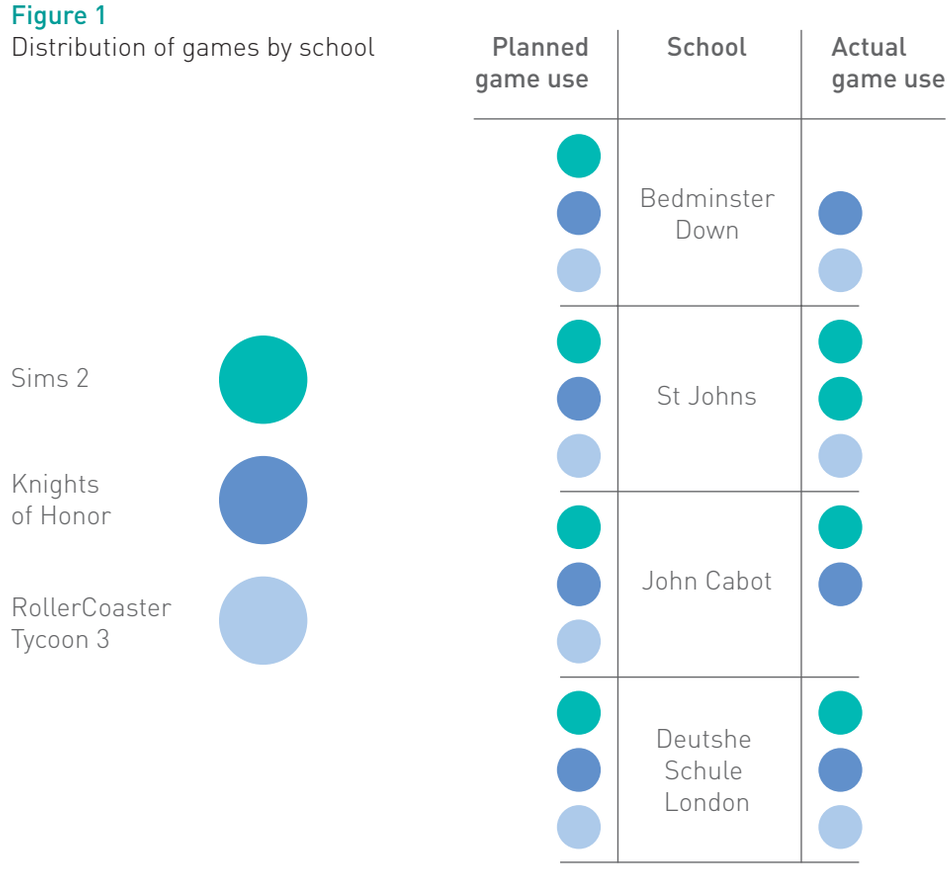
School	Teacher	Gender	Subjects taught	Summary of gaming experience
JC	A	M	CCC	Plays racing or fighting games on PlayStation but not interested in strategy games
JC	B	F	RE	Experienced Sims player
JC	C	M	ICT	Plays various computer games three or four times a week
StJ	D	M	PE	Occasionally plays on a PlayStation
StJ	E	M	English	Occasional PC gamer
StJ	F	M	ICT, French	Had played some strategy games approximately three years ago
StJ	G	F	D&T	Plays sports games
BD	H	F	Science, ICT	Minimal experience of computer games, although has played on a PlayStation
BD	I (SMT)	M	PDC[20]	Occasional PC gamer (with family)
BD	J	M	English, Media studies	No experience of computer games and limited computer use
DSL	K	F	French	Played Mario Bros games when was young
DSL	L (SMT)	M	Maths	No information available
DSL	M	M	Maths	Played strategy games like Lemmings about 10 years ago
DSL	N	F	Maths, Physics	Minimal game experience but can program teaching materials

Table 2
Participating teachers

3.2.4 Teachers' games selection

Teachers were presented with the three selected games during a workshop at the start of the project. Researchers asked teachers to choose games so that each school had one teacher using each selected title. This resulted in three 'games groups', each with four members all using the same title. Teachers were free at any time to change or stop the use of games during the course of the project if they felt the game was inappropriate for their teaching. In the majority of cases, teachers stayed with their selected game through the course of the project. The following diagram provides an overview of the planned and actual games use in each school. The difference between selected games and actual use of games is due either to teachers who couldn't see an appropriate use for the selected game in their teaching and subsequently changed titles, or who ceased participation in the project due to external factors.

Figure 1
Distribution of games by school



3.2.5 Study design

The design of the project was intended to provide an understanding of the ways in which teachers went about exploring the potential (or otherwise) of the selected games for learning in their subject areas, the factors which informed their use of the games, and the ways in which the games were actually used in the classroom context.

Futurelab and the teachers in the four schools collaborated over the course of the project. Futurelab was responsible for selecting the games, for establishing the overarching goals of the research and for collecting research data on teachers' activities. The teachers were responsible for determining exactly how, when and in what context they wished to use the games in their teaching. The researchers, teachers, technical staff and SMT worked together to overcome technical issues, but issues of curriculum focus, pedagogy and use of the games were decided by the teachers both individually and in discussion in their games groups.

The following provides a breakdown of the activities teachers participated in during the course of the project:

June – August 2005	Games, schools and teachers selected for participation.
September 2005	One-day workshop, in which games were presented to all participating teachers. In each school, teachers were asked to select different games to work with, giving three games groups involving four teachers, one from each school.
October – December 2005	Two workshops for each games group held in which teachers shared their experiences of games play, and ideas for application of the game for learning. Teachers prepared lesson plans. Wiki and e-mail lists set up to support collaboration between teachers. Technical issues involved in using games in schools addressed by school technicians, teachers and Futurelab researchers.
January – March 2006	Teachers implemented lesson plans in schools.
April – May 2006	Teachers reviewed and reported back on the implementation and use of games and lessons in schools to Futurelab researchers.

Table 3
Overview of activities

RollerCoaster Tycoon 3 - Atari

Teaching with Games trial at Bedminster Down School using RollerCoaster Tycoon 3

RollerCoaster Tycoon 3 - Atari

The following summarises the data collected by Futurelab researchers during the project:

- All teachers were interviewed at the start and completion of the project, and interviews were transcribed for analysis.
- All e-mails between teachers and with researchers and all contributions to the wiki were collated for analysis.
- All lesson plans, schemes of work and supporting material generated by teachers, and final reports on activity, were collated for analysis.
- An average of two lessons per teacher were observed and videoed by researchers. These observations focused on examining the lesson objectives, interactions between students and between students and teachers.
- Student Research Groups (SRGs)[21] in two schools produced reports on the use of COTS games in formal classroom settings based on observations, interviews and questionnaires of teachers and children being taught with games in the project.

4 Context: survey findings

A key strand of the research was the survey of a representative sample of teachers (both primary and secondary) and students (aged 11-16) regarding their current use of computer games, and their attitudes towards games and learning in school more generally. The following provides a summary of the findings from these surveys (the full report from each survey can be found on the Futurelab website).

4.1 Teachers

The majority (72%) of teachers questioned never play computer games in their leisure time. Despite this lack of gaming experience 36% of primary teachers and 27% of secondary teachers stated they have used games in the classroom.

59% of all teachers would be willing to consider using such games in the future. 67% of teachers aged 25-34 with less than five years' teaching experience would like to use them. "Motivating students" was the most commonly cited reason for introducing games for learning (53% of this group, or approximately 31% of total sample). The next most commonly cited reasons were: the perception that games would offer an inclusive, interactive way of engaging pupils on their own level (18% of this group, or approximately 11% of total sample), and relevance to a lesson/subject area (10% of this group, or approximately 6% total sample). Of those who play computer games, 48% (or approximately 13% of total sample) say that they have already spoken to their pupils about games, and a further 16% (or approximately 4% of total sample) expect to in the future.

The teachers who would not consider using these games in the classroom (37%) express concern that they would have little or no educational value (33% of group or approximately 12% overall) or believe that better resources are available (17% of group or approximately 6% overall). Some also believe that children play enough games in their free time and that the curriculum does not allow time for such activities (for both statements, 10% of group, or approximately 4% overall).

The poll findings highlighted some barriers to the use of games in schools. 49% believed that there would be a lack of access to equipment capable of running the games, and 14% thought there was a lack of strong evidence of the educational value of games (6% thought that games did not have subject and curriculum relevance). Issues such as coping with different abilities, assessment and lesson length were less frequently mentioned; 3%, 2% and 2% respectively. 13% of teachers saw no barriers to using games in the classroom.

The most common reasons for using COTS games is the perception that they improve pupils' motor/cognitive skills (91%), ICT skills (77%), higher order thinking skills (63%), or knowledge in a particular area (62%). Social skills are seen to be a benefit by 17% of teachers. However, 71% believe that playing such games could lead to anti-social behaviour while 62% think it leads to stereotypical views of other people or groups. A significant minority of teachers, especially those in primary schools, give this as a reason for not using games.

4.2 Students

The poll found that 85% of children say they play computer games outside of lessons (at home or at school) at least once every couple of weeks. 22% said they have used such games in class. Boys tend to be the most regular players, with 50% of male students saying that they play every day, compared to only 21% of female students. Younger students also tend to be more regular players of computer games than their older counterparts. For instance, pupils aged 11 and 12 are significantly more likely to play computer games every day (46% and 41% respectively), than 15-16 year-olds (25%).

An average of 62% of students say that they would like to use computer games in the classroom; 89% of these (approximately 55% overall) think it would make lessons more interesting. Younger students were most likely to want to use computer games in school: 66% of 11 year-olds compared to 49% of 15-16 year-olds. However, 22% of students think such games should not be used in lessons. Half of these students (11% of the sample) say that they would prefer to do other activities in the classroom, while more than a third of this group (8% of the sample) would rather use computer games at home.

Amongst all students, there are a number of perceived benefits of playing computer games outside lesson time. More than two-thirds (69%) say that it improves computer skills, while roughly half (53%) think that it would help improve their reactions or problem solving skills. 24% think that it improves subject knowledge, and the same percentage thinks game playing improves skills such as working in teams. Although the perceived consequences of playing computer games are largely positive, students also identified a number of negative potential effects. For instance, 30% of students overall believe that playing computer games could lead to increased violence and aggression.

4.3 Key messages from surveys

First, it is clear that there is still a generational divide between teachers and students in respect of computer games play, with 72% of teachers never playing games outside school in comparison with 82% of children reporting games play at least once a fortnight.

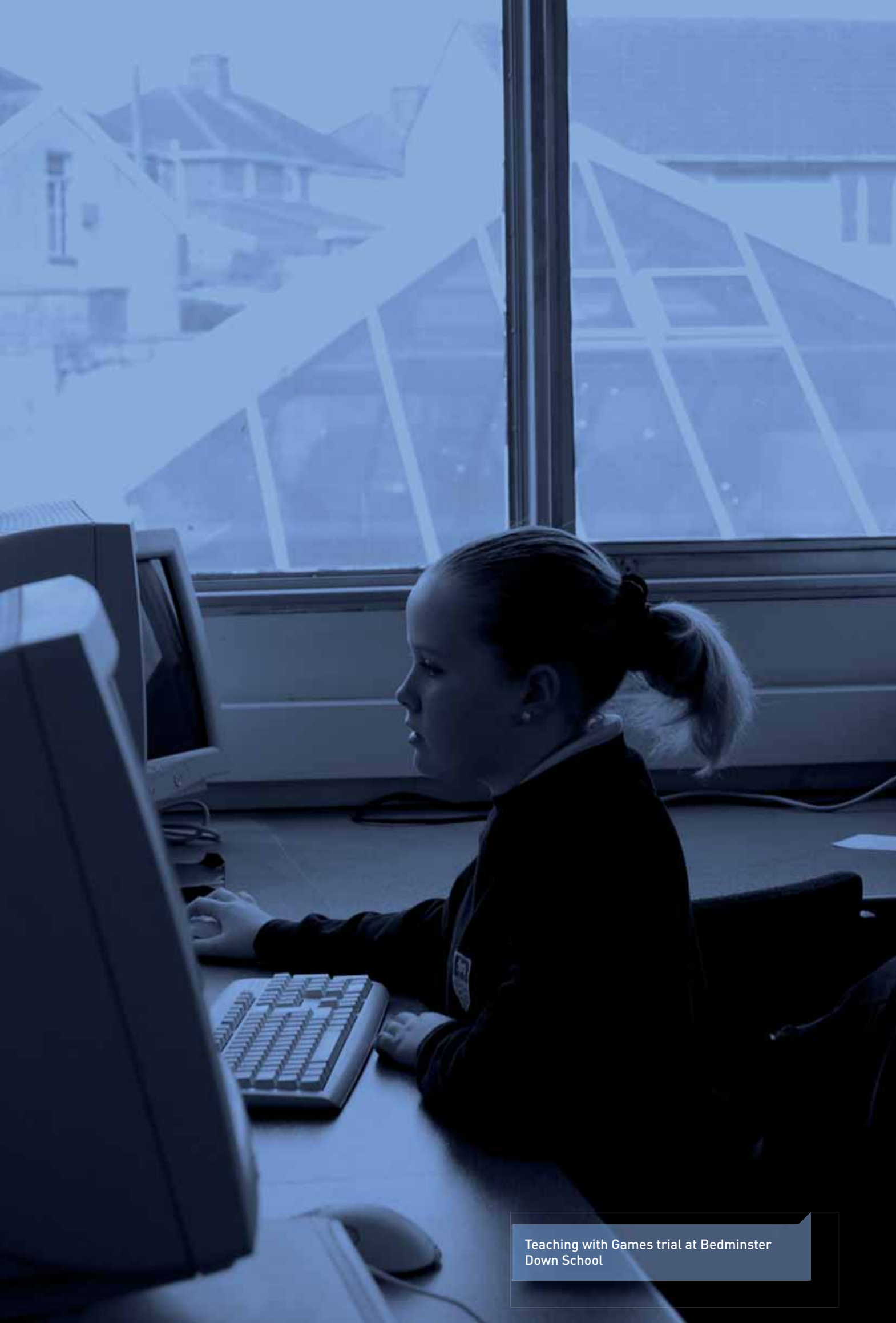
Overall, the surveys suggest that the majority of teachers and students are open to the idea of using games in formal curricular contexts. Both Ipsos MORI polls suggest that computer games are viewed as motivating to students. However, it should be noted that 37% of teachers and 22% of students think that computer games should not be used in the classroom.

Teachers and students have similar perceptions about the advantages and disadvantages of using games. Both groups believe that games play improves computer skills and general problem solving abilities. However, teachers are more likely to believe that students can gain subject knowledge from computer games than children - 62% compared to 24% - while more children believe it improves social skills – 24% compared to 17% of teachers.

Finally, the survey suggests that the main barriers perceived by teachers to the use of games are not those of the curriculum or of assessment, but the technical issues that may need to be overcome.

Knights Of Honor - Black Sea Games

Teaching with Games trial at Bedminster Down School



Teaching with Games trial at Bedminster Down School

5 Case studies: themes emerging

This section outlines the factors which shaped teachers' approaches to incorporating and using games in their classrooms. As such, it discusses various constraints (technical, institutional, temporal) within which teachers were operating in developing their use of games for learning. It highlights the ways in which teachers' different cultural expectations about students' attitudes to and expertise in games use affected their implementation of games for learning. It explores how the introduction of games creates potential tensions between 'games narratives' and 'curriculum' objectives.

The aim of this section is to provide a rich picture of the various factors which impacted upon the process of introducing games for learning in schools, rather than to describe in detail the activities of individual teachers (sample materials will be published on the Futurelab website by autumn 2006). A summary of the lesson plans produced by teachers, the game used, student age group, number of lessons, and learning activities and objectives can be found in the Appendix. We also give a 'flavour' of these activities through the pen sketches of three teachers who all appropriated the games for use in different ways and for different subjects.

5.1 Technical factors

We begin with the inevitable technical issues which were raised and (at least partially) resolved in the early stages of the project, as teachers, technical advisors and Futurelab researchers grappled with the basic question of how to enable games to run easily and effectively in the specific technical context of schools.

Broadly, games were either run on offline laptops or networked PCs. Two of the schools had a network with machines procured from a major national ICT provider. These machines, designed to meet schools' existing requirements, were configured differently to those normally found in homes or offices and consequently presented specific difficulties when using commercial games software, as detailed below. Where teachers used laptops, these were either recently purchased by the school, or were teachers' and their colleagues' personal machines: in all cases, the laptops were of a sufficiently high technical specification that installing and running the games presented no problems.

As might be expected, those teachers who displayed greater confidence using ICT in an educational setting found dealing with some of the issues described less problematic than other teachers. However, the majority of these technical issues were unrelated to individual teachers' level of ICT expertise, instead they arose from specific qualities of the games or the infrastructure in which they were being used.

5.1.1 Installing games

Getting the various games onto the appropriate machines proved more challenging than expected, primarily as a result of the various copy-protection features of the titles. As an example of the kind of problem encountered, conflicts with account management software in one particular school meant it was impossible to install The Sims 2 using multiple CDs, whereas using a single DVD met with success. Administrators were not always able to deploy a game installer across a network in the way they were used to, for reasons that varied across schools despite the similarities of their network configurations. Overcoming these issues was time-consuming and, for those schools that bought external CD drives, expensive. In these circumstances, it is easy to sympathise with (although not condone) the minority of technical staff who felt that downloading a 'cracked' version of the software (one that didn't require a physical copy of the disc and that could be installed across a network as easily as other software in use) was a more efficient use of their limited resources.

The support of the technical staff at the various schools was crucial in getting the games installed and working. In all cases, teachers relied on technical staff to test the games on school machines and to find solutions to any problems they encountered. In some cases, technical staff were unable to do this and as a result teachers were forced to alter their lesson plans accordingly (for example, being unable to run The Sims 2 on one school's network meant one teacher had to run the game on a single laptop, displaying on an interactive whiteboard, rather than having students work individually on the game as intended – this was later described as "not a good approach").

In some cases, testing and installing games on the network was not seen as a priority by technical staff, leading to frustration among teachers. Relationships between teachers and technical staff varied within and between schools. There was little communication between schools' staff regarding technical problems they shared, with the notable exception of the staff of one school, who shared solutions with another school using the same network provider and facing similar problems.

5.1.2 Running games

With the networked PCs, while memory and processor speed were usually adequate, the video cards were not always of sufficient quality to run some games in full colour and at the expected speed (upgrading the cards from a third party was not possible as the dimensions of the PC cases were peculiar to that particular manufacturer). This could lead to minor tensions between students using different equipment (for example, a student using a PC asking another using a laptop, "how come yours is loaded already? Ours is so slow").

Copy protection required a disc to be physically present in the PC at the time it was started up – this was not possible in many cases as the PCs in use had no CD drives. In some cases, this was worked around by using several external CD drives, connected to the PC via USB, but this was an inconvenient task for teachers (or technical staff) to have to complete at the beginning of each lesson using the game. Where a solution wasn't found, teachers had to redesign their lesson plans to take this into account (for example, using a single laptop and displaying the output on an interactive whiteboard).

Performance of computers within a class was not always uniform: the time taken to load the game at the beginning of lessons varied from machine to machine, impacting on teachers' classroom management (the time taken to load games was factored into many teachers' plans, with starter activities planned solely to occupy students while computers booted, but these plans assumed the same wait for all students). There were occasional crashes (not limited to any particular title), and although these were rare they were still of course inconvenient to students, interfering with their ability to work on the lesson tasks.

5.1.3 Saving games

In some cases, pupils had to use the same machine each lesson, which was not always practical with fixed machines, and still problematic with laptops. Some games saved player progress to the Windows location 'My Documents', which wasn't always available to pupils due to the configuration of some school networks. In some cases, games were lost unexpectedly during the lesson, or students learned their work wouldn't be saved after having spent much of a lesson on it, causing frustration. Continuity between playing sessions is an important feature for many games, and without it the richness of the game may be lost; also, work cannot be passed from lesson to lesson and each game must be started from scratch, which is limiting for teachers and frustrating for pupils. As discussed below, this was more important for those lessons centring on the game's internal narrative, such as those using Knights of Honor, than for lessons that centre on teachers appropriating elements of the game: in some cases, it may be that the latter approach was taken as a result of the difficulty encountered when attempting to save games on a school network.

5.2 Institutional and professional factors

The wider culture of the schools in which the teachers were working also provided an important context in impacting on how teachers both prepared for and implemented their plans for using games in schools. Many of these issues

raise wider questions about the organisation of schooling which cannot be fully addressed in this report, but it is worth highlighting these here as they were identified by teachers as significant in shaping their thinking and practice.

5.2.1 Age constraints

The teachers were concerned with ensuring that their students' participation in this project did not impact negatively upon their attainment. As a result, teachers were concerned first, with ensuring that the games used mapped onto their curriculum objectives (which we will discuss later in the report) and, second, that the 'experimental' nature of the project should not impact on students' results in high stakes assessment. As a result, those teachers in the state sector opted to develop lesson plans and activities for students in Years 7 and 8, years often seen as more flexible in that there is no high stakes assessment in operation in these years. In contrast, the DSL school, which had more flexibility in terms of curriculum and therefore more space and time for curriculum innovation, chose students from Years 11 and 12.

These concerns over curriculum and assessment appeared to be more influential in selecting the age groups teachers would work with than the age rating for the games. No teacher expressed concern about using 'teen games', ie those suitable for 13 and over, with 11 year-olds.

5.2.2 Timetabling and lesson lengths

For some teachers, wider timetabling issues affected their access to equipment. Where a computer room was unavailable, for example (because "everyone's gone ICT mad"), one teacher had to change her scheme of work to include more work without computers. It should be noted, however, that even within the same school, different teachers had very different experiences of booking resources such as laptops, suggesting the role that individual and personal relationships play in the distribution of access to such equipment within schools.

As suggested by earlier studies[22], many teachers found the fixed length of lessons to be constraining in both the planning and implementation of games-based learning in schools. In part, this seemed to be a result of the novelty of the activity: teachers were unsure how much time an activity might take, and several expressed confidence that if they were to try similar activities again they would be able to manage classroom time more effectively. The fact that the available time was fixed meant that the impact of any technical issues (loading times, crashes, etc) was more keenly felt than might have been the case had there been more flexibility in the timetable.

There is a more fundamental tension between fixed lessons and open-ended games that presents more of a challenge than resolving purely logistical issues. The natural pauses in play that occur within these games (for example, at the end of a battle in Knights of Honor, or reaching a scenario objective in RollerCoaster Tycoon 3) did not appear to occur frequently enough that teachers could fit them into a single period; additionally, students progressed with game tasks at widely-differing rates, ensuring that even if some students completed a stage in a game within a lesson, other students would not.

The Sims 2 - EA

Teaching with Games trial using The Sims 2

5.2.3 Sharing ideas and professional cultures

Few of the teachers reported talking with other participating teachers or their colleagues about their approaches to lesson plans or to the difficulties they faced, or made use of the opportunities provided by Futurelab to communicate with researchers and other teachers through personal journals, e-mail, or the message board set up for the project (although Teachers H and G had their lesson plans reviewed by their respective heads of department). Although no teachers reported this to be problematic, it was observed that many faced similar challenges and difficulties in designing and implementing their lessons, and a more open and collaborative approach might have saved time spent

developing ideas or overcoming shared difficulties. It may well be the case that in their wider practice teachers are used to working individually, with little peer contact or input, in which case Futurelab might have needed to articulate the value of working collaboratively with greater clarity. Equally, it may simply be that the means provided by Futurelab for sharing ideas and thoughts were inappropriate for teachers without an office or desk and limited access to e-mail and the internet. Either way, support from peers could well have helped participating teachers resolve some of the issues they faced more effectively.

5.2.4 Resource preparation

None of the teachers planned to use the game on its own: all had included the use of worksheets and journals of various kinds within their lesson plans. There were two primary roles for these materials: either to support the learning objectives of the lesson, or to support learning about the game itself in order that the learning objectives could be addressed. These roles are not necessarily mutually exclusive, but were rarely found in combination: only two teachers used worksheets to support learning the game alongside materials designed to help students address the learning aims of the lesson. The primary aim of these tools seemed to be to structure the lesson, to ensure that something that looked like traditional learning work was taking place, and, as one teacher reported, to ensure a minimum ability level amongst students: "I know that they can do it because they've done the sheet".

In the early stages of the project, some teachers expressed a concern that the amount of time needed to develop these materials for use in the classroom would be much greater than that usually taken for the lessons they planned to teach. In the event, most teachers reported spending no longer on the preparation of materials than they would do usually, although this tended to be distinct from the amount of time spent thinking about their plans in the games group and the amount of time spent learning to play the game in the first place.

The consensus among those teachers who made this distinction tended to be that, once sufficiently familiar with the game, creating resources to support its use was no more effort than usual, but that the amount of time needed to become familiar with the game was significant and likely to be problematic for teachers not already familiar with computer games.

The similarity of the resources produced to those normally used to support a lesson (and the similarity of the tasks they supported) might suggest that few teachers had changed their teaching practice significantly, despite the difficulty most faced in thinking about incorporating the game. In some cases, chiefly among those focusing on content rather than skills acquisition, this was consistent with their general approach of appropriating elements of the game,

rather than adapting their teaching to fit the narrative of the game. In others, this similarity between game and non-game resources might suggest that the game added little to their usual teaching, or that its full potential had not been recognised.

What was clear was that the cultures and 'rituals' of classroom practice – from teaching styles to 'best practice' in lesson planning – played a significant role in shaping how teachers approached the task of understanding how games might play a role in their teaching. This was also in evidence when we examine how teachers explored their own role in the classroom when using games (see section 5.4).

5.2.5 Curriculum

The four schools offered three different approaches to curriculum organisation (as discussed in "Competency curricula" in section 3.2.2.). These contexts served to inform how teachers appropriated the games for teaching and learning in sometimes unexpected ways. In general, those teachers following a content-based curriculum felt they would struggle to find a meaningful role for the game within their teaching, while those following competency or skill-based curricula felt that the skills demanded by the game were already recognised in the curriculum, and so were more confident that integrating their game would be straightforward.

For example, teachers involved in the competency curriculum at John Cabot decided to use the games in this context rather than in more formal subject contexts as they felt that the games mapped more easily onto a skills rather than content-based curriculum.

**"I'd probably not use the Sims in my RE lessons as I really can't see a direct relationship to my subject or anything I'm teaching at the moment."
(Teacher B, interview)**

**"There is no subject where this kind of thinking would fit in."
(Teacher L, interview)**

However, this dichotomy between a 'flexible curriculum' approach that lent itself to using games on the one hand and a 'rigid curriculum', subject-based approach that worked against their implementation on the other proved to be misleading. Some teachers who had initially expressed doubts about the possibility of integrating a game into their content-based curriculum were able to produce successful activities that worked within the perceived constraints of their curriculum, while others who had initially been confident that playing the game would map directly onto the competencies that were the focus of their curriculum, found that in practice students needed more support and

structure than had been envisaged. This may be due in part to the personal approaches encouraged by these initial impressions. Those teachers who felt that integrating a game into their teaching would be particularly challenging may have consequently been more detailed about their planning than teachers who perceived an easy fit between the game and their curricular aims.

5.3 Curriculum and game narrative

The previous discussions have related to factors which form the context (institutional, professional and technical) within which teachers were working and which informed their design of lesson plans, and their implementation of games in the classroom. This section focuses instead specifically upon the ways in which the games themselves (their narratives and architecture) interacted with the curriculum contexts in which the teachers were working to inform the design of lesson activities.

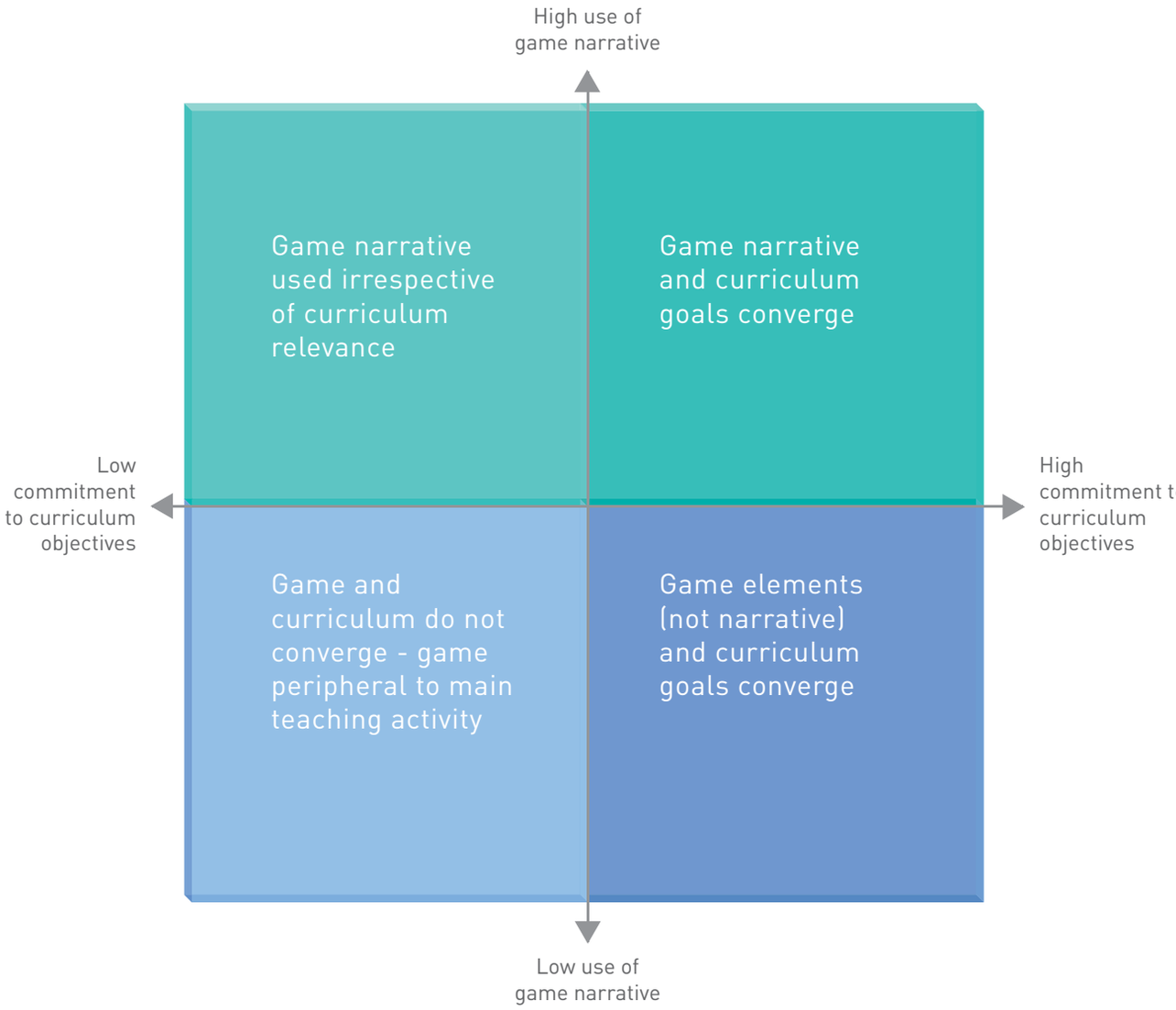
All of the games used in the project were designed primarily for entertainment. In these games, the game designer has a narrative in mind for players to follow, explicitly or implicitly expressed through:

- the game mechanics (the affordances enjoyed by the player's avatar and the interaction of the different in-game variables)
- the interface (through which relevant game metrics are revealed, such as the amount of money available to a ruler in Knights of Honor, or the particular aspirations and needs of a character in The Sims 2)
- on-screen instruction.

Players are not forced to follow this narrative, of course, and in all games there is room for players to explore and to follow their own interests in the game. In order to win a game, however, players have to follow the designer's narrative and pay attention to the routes and elements that the designer has implicitly said should matter.

When considering how best to use a game in their classroom lessons, teachers, of course, have to consider the curriculum requirements of their particular domain. There arises from this imperative a possible tension between following the game designer's narrative and taking part in activities that address the curriculum needs of a lesson; the two are not necessarily in alignment. From our observations of teachers' strategies for managing this potential tension we have produced a hypothetical framework which identifies four approaches that might be adopted in balancing games narratives and curricular objectives. These are outlined in Figure 2 (overleaf).

Figure 2
Hypothetical framework for approaches to balancing curriculum objectives against games narrative

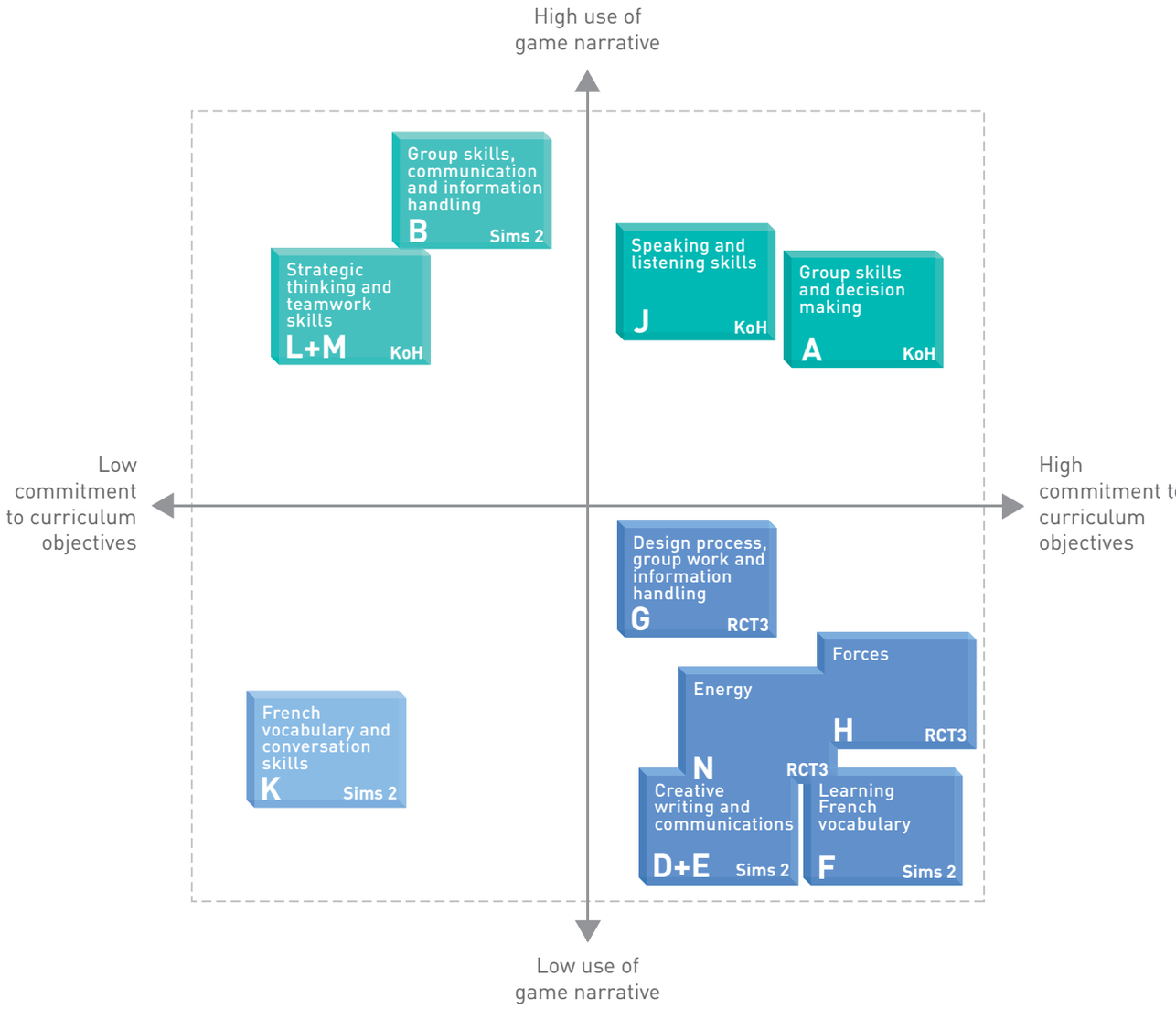


The approaches of the teachers on the project can be mapped onto this framework (see Figure 3 opposite). In their different lessons, we witnessed:

- Those teachers who felt that asking students to follow the game designers' narrative would also allow them to address their curriculum goals (for example, playing Knights of Honor with a focus on strategic thinking and working in groups, Teacher A), seen mainly in the top right-hand quadrant (Figure 3).

- Those teachers who felt that the game designer's narrative was inappropriate for their needs, but who were able to borrow certain game elements to support their teaching (for example, building rollercoasters to certain specifications detailed by the teacher, using the sandbox feature in RollerCoaster Tycoon 3, Teacher N), seen largely in the bottom right-hand quadrant (Figure 3).

Figure 3
Categorisation of case study lessons balancing curriculum objectives against games narrative[23]



- Those who didn't follow the game designers' narrative, or find elements of the game to appropriate, but who used the game instead as a stimulus for classroom-based activity (for example, using The Sims 2 as the starting point for discussions on personal responsibility, or as a stimulus for creative writing, Teacher K), seen in the bottom left-hand quadrant (Figure 3). For this group, curriculum objectives were more often met through means other than playing the game, and consequently the game occupied much less 'space' in their lesson plans; less time was spent using it, less value was placed on the game by the teacher and it was less important in supporting students' thinking around the aspects of the curriculum that were the focus of the lesson.

- Those teachers who would follow the game designer's narrative without focusing on any particular curriculum needs are seen in the top left-hand quadrant (Figure 3). (For example, Teacher L used Knights of Honor to allow his mathematics class to practice team skills, which were not part of the curriculum he originally intended to address).

Teaching with Games trial at Bedminster Down School using RollerCoaster Tycoon 3

Two aspects of the games' design seemed to inform how teachers used the game in the support of curriculum goals:

1. The extent to which elements of the game could be separated out from the whole game narrative and appropriated for specific use by teachers.

2. The extent to which the game was conceived as offering authentic and reliable models of the real world.

Titles varied in the ease with which game elements could be uncoupled from the wider game, or at least privileged over other elements of the game. Elements that were separated out by teachers for use in a discrete fashion outside the overarching games narrative include:

The Sims 2: the ability to export still or moving images using the movie creator for use in other contexts (such as providing scripts in drama or a description in French); the use of the game as an illustration of daily tasks for class discussion; the aspirations and social needs of the Sims as topics for class discussion.

Knights of Honor: using the game as a resource for a presentation on medieval life, for example, asking the students to specifically consider the costumes worn, or the type of weapons that were used.

RollerCoaster Tycoon 3: using the coaster cam to illustrate the impact of forces (for example, students acting out which direction they would be swung going round a corner); using the sandbox which allowed you to test your rollercoaster; or identifying the constituents of a theme park (and receiving user feedback from visitors) in order to help with understanding design processes.

The uses of RollerCoaster Tycoon 3 suggest that this game in particular is one that contains discrete elements that can be separated out and used by teachers without requiring the context of the wider game narrative. Separate elements of The Sims 2 were also used (Teachers D, E and F), for example, using the images on screen as a topic for descriptive writing. In Knights of Honor, however, the various game elements (battles, diplomatic contact with other states, resource management) were sufficiently tightly interwoven that no teachers attempted to extract discrete elements and instead used the whole game in class activities. Interestingly, although it is hard to identify the direction of causality in this instance, all of the teachers working with Knights of Honor and following the games narrative closely were also those attempting to teach competencies (listening, strategic thinking, problem solving etc) rather than understanding of factual content. Whether this game was selected as a result of these teachers' curriculum focus, or whether the game itself determined what teachers felt could be taught, is not clear.

Knights Of Honor - Black Sea Games

RollerCoaster Tycoon 3 - Atari

The Sims 2 - EA

One particular issue that arose when considering parts of the games that could be appropriated by teachers was the veracity of the underlying game mechanics and the assumptions made by the game designers. Teacher B and Teacher K's lesson plans were premised upon The Sims 2 offering a sufficiently realistic model of real life to be of benefit in discussions. This attitude to the representational veracity of the game is also present in students views:

"The Sims 2 teaches you the social skills of life, helping you to understand your basic needs to lead to a healthy and happy lifestyle, and preparing you for all the responsibilities of adulthood." (from Teacher B's class)

"You can act with your Sim, what you think you will be like when you're older." (from Teacher B's class)

"It teaches you how to organise a family, how to keep them happy and how to keep them alive." (from Teacher K's class)

RollerCoaster Tycoon was assumed to have a sufficiently accurate model of the factors contributing to a theme park's success by Teacher G that it could be used as a reference when implementing a design process. Teacher H and Teacher N both found that the individual rollercoasters had qualities that could be described in scientific terms to a useful extent, although both had reservations about the accuracy of the underlying physical model, with Teacher N suggesting that only coasters using five or more wagons behaved as would be expected. Teacher A viewed Knights of Honor as sufficiently accurate in its representation of historical artefacts to be useful as a research tool.

It is clear that for the game to be of benefit to some teachers, it need only be accurate to a certain degree; there may be wider inaccuracies within the game model, but these do not necessarily preclude the game from being used meaningfully in a lesson.

There was one planned activity in which the underlying model of the game was to be the focus of a learning activity: Teachers L and M had originally planned to ask students to use the modelling software 'Dynasis' to represent the interrelating variables within Knights of Honor, in order to be able to predict the most effective strategies for playing the game. In the event, inferring the underlying system from the game behaviour proved to be unworkably complex and the plan was not implemented. Had there been more information available describing the "mutual dependence of the various parameters of the game" (Teacher L, report), this might have been a novel way to learn about complex multivariate systems and dynamic processes.

5.4 Teaching styles

So far, we have discussed the various external factors which contribute to how teachers decided to use games for learning. We now turn to the more personal question of teachers' personal and professional approaches to teaching and their own 'games literacy'.

It might be expected that teachers' level of familiarity with the game itself would act as a defining factor in determining the enthusiasm and success of teachers in incorporating games in the classroom. From our observations and analyses, however, while a certain level of familiarity with the game was necessary for its incorporation into the classroom, achieving particular educational objectives through the use of the game was more dependent upon the individual teacher's grasp of the curriculum/subject area in which they were working.

Where teachers were experienced in the subject/curriculum area they were addressing, they were able either to appropriate only those game elements that

would support their teaching (and so, in some cases, make their lack of game literacy less of an issue) or to scaffold students' use of the game appropriately. This point was reinforced by one teacher, when asked what another teacher might need to know:

"I'd say they'd need to be really clear about what learning they want out of it before they went down the road of using it. So that they can always bring the focus back to the sort of learning activities." (Teacher G, interview)

Conversely, there were a minority of teachers who were perhaps more fluent with the game than in the relevant curriculum, whose lessons didn't go as far in addressing their stated learning aims as some of their colleagues.

In observing lessons, it was clear that teachers adopted a number of roles when using the game in their lessons, often acting in multiple roles over the course of a lesson, in addition to those roles they might expect to occupy in the course of their normal teaching (organising students into groups, managing class behaviour, setting goals for the lesson and so on). All teachers had to provide some degree of technical support, or mediate between students and technical staff if they were unable to answer a query.

In the cases where students were watching one of the class use the game on an interactive whiteboard, the teacher acted as an interpreter, mediating between the class and the player and recasting the events on screen in the context of the learning aims for the lesson (so for example, Teacher E prompted the class to think about what they might learn from the actions of a Sim, in the context of a creative writing lesson where students were writing character sketches for the members of a Sims family). Other teachers took a scaffolding role during the time students were playing the game, allowing them to explore the game but supporting their play through structured tasks and other materials (for example, Teacher A moved around groups ensuring that teams recorded relevant information in their journals, and Teacher N structured students' play through worksheets and pre-constructed rollercoasters). Teacher J took the role of facilitator, managing the class and maintaining discipline but providing little explicit structure during the lesson. Many teachers appeared happy to take the role of learner, acknowledging students' greater knowledge of the game where applicable.

Prior to observations, researchers had expected that teachers might be uncomfortable with the possible loss of control that can arise from the potentially autonomous nature of computer gamesplay. In the event, however, only four teachers developed activities which attempted to circumvent this possibility. One teacher commented, after a series of lessons in which the use of the game was for the most part tightly structured:

"I was thinking ooh yeah, you'd be doing the kids a really big favour giving them lots of game time. [But] too much game time and they go off and the classes aren't run properly." (Teacher H, interview)

Another, an enthusiastic user of the Sims, was keen to see students get further into the game. However, in practice, he structured the classroom activities in a way that ensured students had far less influence on events in their games than the teacher. Similarly, Teachers D and E designed their lessons in a way that minimised the number of students who were able to play the game.

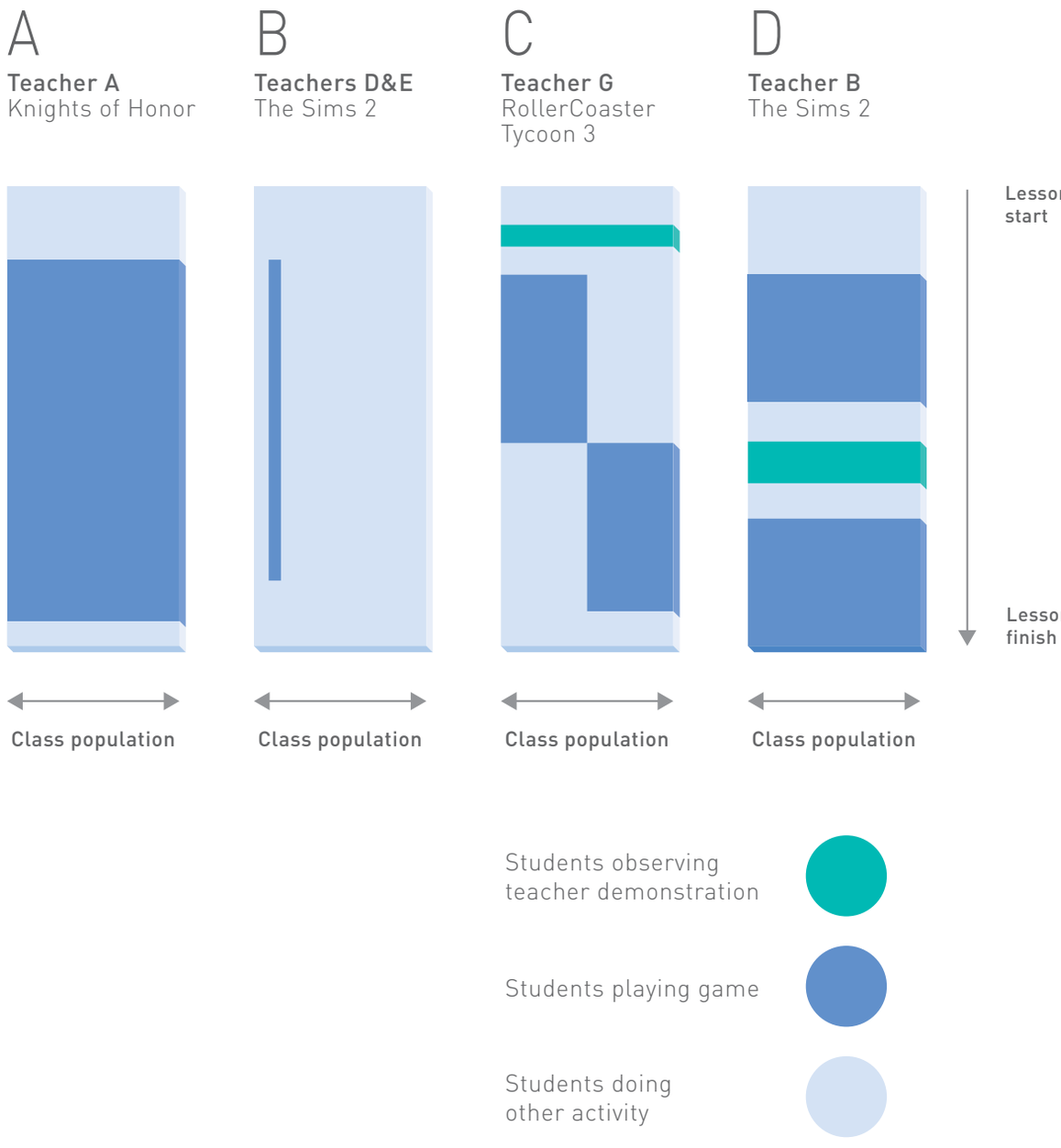
The role of the teacher, in encouraging students' reflection and ability to make links between their game activities and the wider learning aims of the class, was acknowledged by the majority of teachers through explicitly allowing time for plenary sessions within their lesson plans. The constraints of the timetable and the longer time taken by students to complete game tasks meant that in practice, however, many teachers spent less time than planned supporting students' reflection on their learning. On completion of the trial schemes of work, the majority of teachers suggested that this was something that would need to be taken into account in running these activities again.

Figure 4 provides a diagrammatic summary of the way in which classes were organised by four of the teachers. This figure highlights the diverse approaches to incorporating games into the lesson structures and teaching styles adopted by the different teachers. There is no decisive correlation between the teaching approach adopted and either the game used or the curriculum context. As such, it suggests that the incorporation of games into formal educational environments may be more a reflection of individual and school attitudes towards teaching styles than a necessary outcome of either the game or the curriculum context involved.

In Figure 4A the teacher began by discussing the lesson goals and reiterating the competencies expected. The entire class then played Knights of Honor in their groups with the teacher going round and discussing the tactics with the teams. Prior to the end of the lesson the students were asked to switch off the machines and a short plenary was held.

Figure 4B shows a lesson where there was an introduction, followed by two students playing the game with the rest of the class observing, ending with a class discussion of the events seen. During the time when the Sims was displayed on the large screen the teacher was discussing the type of actions the students could describe in their written exercise to create a news story based on the lives of the Sims.

Figure 4
Representations of student activity and games use during four lessons



In 4C the teacher demonstrates how to use RollerCoaster Tycoon to her class. She then divides them into two groups with half playing the game in groups and the others doing practical design tasks based on requirements identified by playing the game. Halfway through she switches the teams. At the end there is a short plenary.

Finally in 4D the lesson is divided into sections. Initially there is a discussion of the goals for the lesson. The students then go through the Sims tutorial. Next the teacher describes the actions expected of the teams of students and demonstrates some of the skills she expects them to use. In teams they then complete the worksheet given.

With the possible exception of the technical support role, none of these activities seem to be specific to the use of games in a classroom. While there is insufficient data to make any claims on the approach taken by teachers outside the lessons observed, it might be reasonable to assume that teachers' attitudes towards to using ICT more generally, and their personal identities as teachers, informed their choice of 'teacher role' when using the games. The use of the game takes place within a wider context of teachers' personal and professional experience: the roles taken by teachers might be assumed not to be radically different from those adopted in lessons not focusing on games.

5.5 Teachers' expectations of children's games literacy and motivation

Finally, an important factor in determining how teachers went about planning and implementing the use of games in their classrooms, is the wider cultural assumption of children's natural affinity with and motivation to play computer games. This is an assumption which is not only specific to the teachers in this study, but is evident more generally in public and media views of children as a new 'digital generation'.

All the teachers in the project had assumptions about their students' motivation and game literacy which implicitly informed the design of their lesson plans and auxiliary classroom materials. These assumptions were both positive and negative. In some cases, teachers assumed that students would be more accomplished than they were:

"I did have an expectation that they'd all be really good at it. And they weren't all really good at it." (Teacher G, final interview)

Others assumed that students would require more support when learning the games:

Teacher A

Teacher A is an experienced teacher and had been responsible for authoring the new 'competency curriculum' at John Cabot. While enjoying playing console games (particularly racing and fighting games) he had little or no interest, for his own entertainment, in the sorts of strategy games that were selected for the project.

This teacher, at the first workshop, selected the Knights of Honor game for use as part of the competency curriculum with his Year 7 pupils. Through playing the game and talking with colleagues he focused his use of the game on three competencies: 'finding and using information', 'team work' and 'communication'. He set aside 16 lessons for the scheme of work he developed.

The first activity involved a plenary session introducing the game and objectives for the programme of work to students. They were then organised into self-selecting teams of four or five. The goal for the teams was to play Knights of Honor with the goal of conquering Europe. Teams were organised into distinct roles, with different children taking on the role of, for example, leader, 'driver' (controlling the computer), scribe or timekeeper. On completion of the game, Teacher A was to run a plenary session reflecting on the different skills the students had had to use in the game. Finally, students were asked to use the game as a resource alongside the internet and books in creating a presentation on medieval life. The students were expected to evaluate the efficacy and reliability of the game as an information resource against these more conventional tools.

In practice, the students took significantly longer to develop competency in playing the game than had been envisaged, a fact which led to time constraints within the lessons. As a result, the reflection stages planned by the teacher were often missed out. Despite this, the teacher reported high levels of engagement and motivation amongst the students and reflected that, should he use the resource again, he would have a better idea of the time issues involved and be better able to ensure that space for reflection and critical analysis was more systematically built into the activities.

Teaching with Games trial using Knights of Honor

They didn't use my manual – I created a manual to help them play the game and they didn't use it!...They're quick to pick it up." (Teacher N, final interview)

At the same time, the majority of teachers entered the project with the expectation that games use would be intrinsically motivating to the students:

"I'm a real believer in anything that can be used as a motivational tool, to engage, excite and motivate kids, in the topic they're learning... It would be exciting and up to date and would appeal to students, after all a proportion, a fair proportion, have computer games, have good hardware and software at home." (Teacher D, first interview)

"Kids can do games." (Teacher H, first interview)

"The main hook is that students want to use games." (Teacher A, first interview)

In some cases, however, we witnessed a disconnect between teachers' conceptions of student games literacy and motivation and students' own conceptions, a disconnect which resulted in sometimes unexpected experiences in the classroom. The following section discusses these two factors in more detail.

5.5.1 Motivation

The survey of teachers' attitudes to using games in school reports that 53% of teachers see children's motivation as the primary reason for using games for learning. Similarly, the teachers involved in the project viewed enhancing student motivation and engagement as an important reason for exploring the potential of games for learning.

From observations and interviews with students (carried out by researchers from Futurelab and the two Student Research Groups) the motivational 'impact' of having used games in class was borne out by many students. Remarks such as these are representative of feedback received from students:

"It's not like a boring lesson, you actually have fun and at the same time learn something." (Year 7 boy, John Cabot, KoH)

"It was better than a normal text book lesson because that's really boring, so it made it more interesting." (SRG report, St Johns)

It is worth, however, probing in more detail the features of games which support motivation, as the expectation amongst many teachers (and amongst Ipsos MORI poll respondents) is that the simple use of games in school is sufficient to generate engagement amongst students.

This motivational effect of games, for example, is often ascribed to 'higher production values', and while it is undoubtedly true that the commercial games used in the four schools have more detailed graphics and glossier interaction elements, there may be other reasons for these games engaging students. One student commented that:

"There was one class where they got to play games they play at home but we had to do Knights of Honor and they got to play Sims and RollerCoaster Tycoon." (Year 7 girl, John Cabot)

Teaching with Games trial at Bedminster Down School using Knights of Honor

Teacher F

Teacher F is head of languages and ICT. He reported some use of strategy games outside school but, in our initial interviews, reported no strong feelings about whether games would or would not be effective for supporting student learning – although he did expect games use to motivate students.

In his planning, he intended students to work individually using The Sims 2 to create environments for their Sims families over the course of two lessons. His rationale for this design was that the creation of a French Sims environment would require researching issues of French geography and culture (that is, examining what makes up a typical French landscape, house and family) and learning simple vocabulary in order to create the environment. The goal was that the students would learn new vocabulary from the context (for example, when the word 'chargement' appeared on screen they could infer that it meant 'loading') in addition to having to recognise known vocabulary, like the word for 'cooker', when building a Sims home.

Unfortunately, technical constraints impacted this teacher's plans significantly. The software would not install in French across the network, removing the possibility for individualised access to the game. Instead, one student at a time was asked to interact with the Sims on a whiteboard while the remainder of the class watched and gave instructions in French. On the basis of this activity, the teacher asked each student to write a story using the vocabulary and concepts learnt in the lesson.

Teaching with Games trial using The Sims 2

On completion of the project Teacher F was positive about the use of games in the classroom. The use of vocabulary in context was felt to be more memorable than a list of words, and the students were motivated and enjoyed the experience, a contention which was supported by the findings of the Student Research Group in the school.

Perhaps the connection games make with students has more to do with their position as familiar artefacts from their wider culture than with the quality of their graphics: COTS games might simply be more relevant to students than 'edutainment' software. As a result, motivation would arise not necessarily from the use of any game ("we had to do Knights of Honor") but from the use of games with which students were familiar ("they got to play Sims and Rollercoaster Tycoon").

Another source of games' motivation could stem from the inclusion of elements that encourage autonomous exploration of the gameworld. For example, two students discovered that peeps'[24] balloons in RollerCoaster Tycoon 3 pop when clicked on – this discovery led to a couple of minutes of looking for balloons to pop. This feature didn't directly add to the game narrative (building a successful theme park), but it reinforced feelings of agency and autonomy (it creates the impression that players can control every element, even down to individual balloons) and demonstrates the benefit of exploration (players never know what might be discovered through experimentation). The autonomy inherent in playing a game might be an important factor in games' ability to engage: in the view of one student, a strength of games is that the teacher:

"...doesn't need to explain anything to us and lets us get on with it." (Year 7 girl, John Cabot, KoH)

As a result, lessons which build on this freeform and autonomous exploration of games might be expected to yield more engagement than those which adopted more 'managed' approaches.

At the outset of the project, however, there was little discussion amongst teachers and researchers of the features of games that might contribute to children's motivation to play. As a result, lesson plans which were not structured to build on these 'engaging features' often saw lower levels of pupil engagement. For example, one pair of teachers focused on the game's motivating qualities as a key element in their lesson planning, yet presented it to the majority of the class in the same way as they might have used a video, bypassing the opportunity for students' hands-on and exploratory play.

While increased motivation and engagement of students was uniformly represented by teachers as a positive effect, they and the students were clear on completion of the project that motivation by itself doesn't help students learn. One student responding to being asked whether games helped them learn by the Student Research Group at St Johns said, "Not really, it's just more interesting", and many gave the impression that it wasn't "real work". The Student Research Group at DSL reported that while many of the students playing the Sims appeared motivated, this motivation was not uniformly applied to the learning tasks set by the teacher. The fact that motivation to play games can also serve as a distraction from educational objectives was highlighted by Teacher G:

"Put a computer with anything in front of children, that's what they'll watch, they won't pay attention to you." (Teacher G, interview)

Additionally, in all classes there were a minority of students for whom the use of computer games was actively demotivating, whether because they lacked any interest in computer games, or as a result of students' existing assumptions that games did not belong in the same domain as 'learning'.

What was clear was that the expectation that games would be intrinsically (and in whatever way they were used) motivating for all students, informed the ways in which teachers went about designing their lessons. In future, it would be helpful to explore in more detail:

1. The features of games which support motivation and the ways in which these can be drawn upon and incorporated into lesson design.

2. The need to develop multiple strategies for the use of games so as to account for those children with little interest.

3. The need to identify strategies for 'managing' the motivation and engagement with games in the classroom context.

5.5.2 Games literacy expectations and experiences

During the course of the project it became apparent that some students were able to use the games software with greater fluency and confidence than others, displaying greater ability and becoming comfortable with unfamiliar game elements with greater speed. This fluency appeared to be not only a familiarity with general interface elements and the use of peripherals, which might be a reflection of broader levels of ICT skill, but also a readiness to understand the underlying narrative of the game and its elements. Not only understanding that a picture of a door in the menu means 'exit', for example, but also that the red numbers that float away when parts of a rollercoaster are deleted are being replaced in your bank balance. In part, this might reflect a familiarity with the semiotic vocabulary of games designers. It may also reflect an ability to transfer knowledge and skills across titles, so for example realising that the camera might be controlled by the mouse in this game as in past games played. This general ability to navigate and interpret games environments we describe as 'game literacy'.

All teachers were comfortable with the possibility that their students might have a greater level of expertise than them in playing the game, with one commenting that he was "used to saying to children, look, I'm not an expert on this" (Teacher J, interview).

Many teachers developed new approaches to teaching and learning on the basis of these expectations of student expertise. For example, in five instances, teachers used the skills of 'expert groups' (pupils possessing some skill with

Teacher N

Teacher N was an experienced maths and physics teacher. In her initial interview she reported no games play other than Minesweeper. However, she was a very competent user of ICT and had created simulations that her students could use to observe ray motion in light. Her approach to using games was initially sceptical and she believed that while her students might be enthusiastic, they would gain only superficial understanding of concepts from games play.

Teacher N worked with RollerCoaster Tycoon 3 and used the sandbox area of the game (the element of the game which allows players to create new rollercoasters). The lessons were supported by a significant amount of preparation, including a manual with reminders about how to play the game, worksheets to work through and 12 pre-prepared rollercoasters. Students were organised into pairs with one group of three.

The activities were constructed first to introduce the game, and second to draw students' attention to the factors that impacted the performance of a rollercoaster. Students were asked to work through various individual factors in designing rollercoasters, including friction, launch speed and height, and were asked to draw graphs and work out relationships between these factors. In the final lesson they deduced the formula for kinetic energy. The amount of preparation done by Teacher N meant the lesson plans were followed as intended, including plenary sessions around a whiteboard at the front where the generated graphs were discussed. The focus solely on the 'sandbox' did mean, however, that some students felt that some of the fun was taken out of the game.

Teacher N conducted a pre-assessment of students' physics comprehension and game skills in the first of the double lessons and repeated this assessment at the end of the third double lesson. All the students had improved in physics though not as much in game skills. Teacher N was also pleased with the concentration and motivation displayed, reporting that students worked through their breaks and she was able to spend more time with individuals as the others were content to work in their teams.

Teaching with Games trial using RollerCoaster Tycoon 3

the particular title) to build in-game resources prior to the lesson, or to mentor peers during the lesson, through matching 'experts' with less able students in groups. The selection process for these groups varied: in some cases, teachers were satisfied with students' own assessment of their abilities (with one teacher happy to move students on if they proved not to be as competent as claimed), while in others teachers constructed selection tasks for potential members to complete, such as creating a family in the Sims or navigating through a certain set of menu items.

These selection processes, however, in common with other means of assessing students' game literacy (for example, Teacher H's worksheets with in-game tasks for RollerCoaster Tycoon 3), did not always provide teachers with an accurate picture of students' ability. For example, Teachers D and E asked students who had identified themselves as experienced players of The Sims 2 to complete a short series of tasks in order to demonstrate their level of ability: to start the game from the menu, to move around within the environment and change camera angles, to create a family of Sims and make it 'function', to build and furnish a house. These experts would then individually take control of the game in classes, with their actions in the game projected on an interactive whiteboard.

However, when lessons were observed, it was seen that the controlling expert was sometimes unable to orient the viewpoint or attend to the needs of the Sims, and misinterpreted data presented by the game, for example diagnosing one Sim suffering from a lack of social interaction as one who didn't like social interaction. One session ended with the death from starvation of two Sims, with their baby taken into care: fine material for the journalism exercise being undertaken by the rest of the class, but embarrassing for the 'expert' in front of the class. It is possible that nerves played a significant part in this apparent lack of fluency (a class of peers is daunting). However, another possibility is that the 'expert' was simply being asked to play the game in an unfamiliar way: on her own, being asked to fulfil tasks in the game ("Can you find the baby for us? Where's the daughter gone?") rather than following a playful set of activities, perhaps with a friend. It was noticeable that when joined by another member of the expert group, their combined performance was improved.

Students displayed a wide range of levels of games literacy. Some students were familiar with the titles being used in class, others hadn't played these particular titles before but were regular gamers, while others had little interest in computer games. This variation in game literacy had an impact on teachers' lesson plans. In general, there seemed to be an expectation that students would be more competent using the game in class than they were seen to be.

This disconnect between expectations of students' ability and their observed ability in the context of the class was seen across all four schools, with the majority of teachers reporting some surprise at the time taken to complete tasks using games. Teacher B provided comprehensive guidance on building a house in The Sims 2, in the form of class tutorials and worksheets, but students still took more time than expected:

"And I did kind of double the amount of time I was taking to do it and thinking right well it took me this long, it's going to take them twice as long. But instead it was taking them four times as long." (Teacher B, interview)

Teacher H reported surprise at the difference between her expectations and students' performance:

"It was just really bizarre because even the kids that did play the game and said that they were very good at it, still made mistakes. And they made mistakes that I didn't think they would make." (Teacher H, interview)

What seemed to emerge from the study was not necessarily a sense of teachers having 'inaccurate' views of their students' games expertise but, more specifically, that children and teachers were operating with very different models of what constitutes 'expertise' in games play. This is highly unlikely to be an issue relating only to the teachers involved in the project, but may more generally reflect a generational difference between adults and children in the practices and competencies used to approach games play.

For example, both researchers' and teachers' conceptions of 'games expertise' were, at the start of the project, more linear than students'. Teachers and researchers appeared to conceptualise students as being at different levels of expertise (for example, novice, beginner, intermediate, expert) and also to assume that within these levels of difficulty tasks were equivalent. This would make it safe to assume that if a student could do task X, he or she would also be able to do task Y, if Y was assumed to be of a similar level of difficulty. There seems to have been a further assumption, that tasks of a certain difficulty would be attempted only after tasks of lesser difficulty had already been mastered. As an ad-hoc model of competence (one likely shared by many) this seems to be underpinned by commonsense. When tested as a working assumption with students, however, this model was inadequate to describe students' actual use of games. Students appeared not to draw the same distinctions between levels of difficulty within the games as teachers, displaying a confidence with some tasks assumed by teachers to be 'expert' (for example, using cheats, or working out how to import images into RollerCoaster Tycoon 3) while still finding basic menu tasks difficult. Students seemed to have 'spikes' of expertise, rather than displaying the linear model that might be assumed as commonsensical.

What was clear was that the expectation that student expertise in games play can be conceived in a linear model was problematic as a conceptual model to underpin the design of learning activities with computer games. This suggests a need for further research in order to understand the different conceptions of expertise held by students and operationalised in practice. Teachers also suggested that different approaches for understanding and ascertaining their individual students' games expertise would need to be developed and incorporated into the early stages of planning for games application in the classroom.

6 Discussion

The Teaching with Games study, despite being conducted on a small scale, identifies a number of areas which would merit further discussion and investigation, and highlights a number of key practical recommendations that would benefit teachers in any future use of COTS games in schools.

Our intention, at the outset of this project, was not to provide an account of the value of games use in schools, but instead to provide a rich picture of the factors which shape how teachers develop games-based learning in schools. This focus, we believe, complements the existing research and practice in this area by providing insights into the context in which teachers are operating in exploring this emerging practice, insights which should be of benefit both to other teachers and to developers and publishers interested in exploring whether commercial games can be used in educational institutions. What is clear, on conclusion of the project, is that the factors which shape teachers' approaches to games-based learning are not related solely to the use of computer games for learning, but reflect a broader set of issues around both the use of digital technologies more generally and, arguably, the processes which serve to shape any form of educational innovation.

We have structured the following discussion into two sections: first, a discussion of questions raised and assumptions challenged by the findings of the project; second, a set of key practical recommendations which should be explored by those wishing to develop games-based learning in schools.

6.1 Questions raised and some assumptions challenged

The MORI survey conducted as part of the study emphasises the extent to which a generational divide in computer games use still exists between teachers and pupils in schools. While 72% of teachers do not use games outside school, 85% of pupils play games at least once a fortnight outside lessons. While the majority of respondents in both groups share an expectation that the introduction of games for learning would enhance pupil motivation, what was unexpected was the emergence of a seemingly new generational divide between teachers and pupils (perhaps between adults and children more generally) relating to the concept of 'expertise'. What emerged from the study was a sense that new models of expertise are required in order to understand how pupils come to be competent in games play, and that linear concepts such as 'novice/expert' do not satisfactorily account for students' practices. Without such new models, it will be difficult to easily understand how best to organise and plan games-based learning activities in classrooms.

Teaching with Games trial at Bedminster Down School using Knights of Honor

At the same time, the study challenged the sometimes prevalent view that simply introducing games into the classroom would prove motivating for students. While teachers and students in the case studies reported high levels of engagement and motivation in the ways in which most teachers appropriated games in the classroom, it became clear that it was not simply the presence of the game which engendered such engagement. Instead, the study suggests that we need to pay closer attention to the specific features of games play which encourage student engagement – whether this is the degree to which children enjoy having fluid and autonomous control over a responsive environment, or the extent to which it is the enjoyment of using games familiar from home and leisured play in which they can demonstrate expertise. What is clear is that we need to move beyond the generalisation that children 'are motivated by' playing computer games, towards a more nuanced understanding of exactly what in games play is motivating in order to best understand how to engender such engagement in the classroom.

Previous studies have argued that computer games have the potential to support children's thinking skills, collaboration and communication skills and have suggested that one of the primary barriers to the use of computer games in schools is an overly rigid subject and content-based curriculum. Indeed, at the outset of the project both teachers and researchers expected greater alignment between the competency-based curriculum run by two of the schools and the sorts of skills children are reported to acquire in playing computer games. What became clear throughout the course of the project, however, was that the effort required by the teacher to engender such competencies through games play in the classroom required the same levels of support and structure as those required by teachers working in a subject-based curricular context. Rather than witnessing a seamless and easy alignment of games play with competency-based curricula, then, it became clear that teachers needed to spend as much time encouraging reflection and focusing specifically upon such skills development as the teachers working in a content-based curriculum were required to do in articulating the acquisition of concepts and content knowledge through games play.

It is far from clear to us, now, that the curriculum itself is the primary barrier to the use of games in school. Instead, we would suggest that the successful use of such games is, unsurprisingly, a reflection of the quality of teaching. Namely, the extent to which the teachers were:

- able to accurately judge their students' abilities
- clear about the educational objectives they were hoping to achieve
- effective in deploying the games resources in meeting these objectives.

It should be noted, however, that while teachers working within subject-based rather than competency-based curricula were able to successfully incorporate elements of games into their teaching, they did so at the expense of the overarching narrative of the game and had to spend significant amounts of time in preparing specific features of the games for use in class.

Previous studies have suggested that a major barrier to the use of games in school is the lack of realism in the underlying models of games. From this study, however, we would suggest that the teachers were comfortable working with resources which were not 100% accurate models of the real (or historical) world, and instead, operated with a principle of 'sufficient accuracy' for the task at hand. What would have been useful, however, and what would have enabled more complex and interesting lesson activities to be developed, would be the clear definition of how the underlying games model operated.

Finally, the Teaching with Games study has highlighted the rich and complex context into which computer games are introduced when they are appropriated within schools. We suggest that, as with any form of curriculum innovation, particularly around the use of technology, the following factors all play a role in shaping how teachers conceptualise the potential use of games in school and how they are able to implement these ideas in lessons:

- the technical infrastructure of the school (including personnel and facilities)
- institutional and professional factors (including the organisation of time and space in the school, cultures of collaboration/knowledge sharing, traditions of 'best practice' in lesson planning, and classroom rituals)
- the extent to which games can be 'disaggregated' and appropriated to meet specific needs
- the individual teachers' personal experience of games play, and their personal and professional identities as teachers
- the pervading cultural expectations of children's attitudes to and expertise in playing computer games.

We hope that by highlighting these different factors which shape how teachers might appropriate games in schools we have offered a richer and more complex picture to both policy makers and developers interested in exploring the potential use of games in education. Encouragingly, although it has been noted that in this kind of research games rarely continue to feature in teaching once the project has ended[25], three of the participating teachers are using revised versions of their games-based lesson plans over the next year, and more have expressed an interest in using games in their teaching in the future.

6.2 Practical recommendations

The following set of recommendations identifies actions that need to be taken in order to ensure a closer fit between teachers' needs and computer games resources, or to better enable teachers to use existing commercial computer games.

For policy makers

- The introduction of games into existing school contexts is unlikely to provide a 'magic bullet' to issues of disengagement and disaffection with learning. While both students and teachers report high levels of engagement and motivation in game-based learning, a number of technical, pedagogic and organisational issues will need to be addressed in order to ensure that these resources can be used for maximum benefit for teachers and children. These are outlined below.

For developers

- New approaches to licensing and copy protection need to be explored and developed in order to allow easy installation and running of games on school networks.

- Guidance information for technical support teams in schools would be useful to aid the installation and use of games on school networks.

- Guidance information for teachers, on the models underpinning games, on overall games content, and on elements of games which can be disaggregated for separate use would be useful to aid the incorporation of games into classroom settings. Teachers would be more confident in the veracity of the software and able to create more complex lessons if they knew the underlying principles within the game.

- More frequent save positions would aid the introduction of games into school timetables.

For teachers

- Teachers should ensure that they are clear about the learning objectives they are intending to achieve over the course of a scheme of work, and identify the precise role to be played by using the game in achieving these.
- Games do not have to be used in their entirety in order to support educational goals and stimulate student motivation – in some cases, certain elements of games can be extracted and used productively in isolation from the game as a whole.
- Teachers should allow sufficient time for both them and their students to become familiar with the game – this may be more time than initially expected.
- Time for encouraging reflection and review of games-based activities needs to be systematically built into lesson plans, with contingency set aside for technical issues that may emerge during games play.
- Working with 'expert' student groups may be beneficial in developing new approaches to teaching and learning. However care should be taken to ensure that these experts are supported and confident in playing this role in the classroom.

For schools

- Teachers benefit from support in order to use games effectively for teaching – support from technical staff is essential, and support from other teachers working on the same problems is desirable.
- It may be desirable to develop greater flexibility in timetabling and organisation of lessons in order to allow teachers to fully explore the potential of working with games over longer periods of time.
- Schools could do more to encourage cultures of collaboration, promoting the benefits to teachers of working with professional peers, as well as providing the means to facilitate this.

Endnotes

1 The games under discussion are sometimes referred to as 'entertainment', 'mainstream' or 'commercial, off-the-shelf' games (often abbreviated to COTS). These terms all refer to games that have been developed primarily for entertainment, rather than having an explicit learning goal in mind, and tend also to describe those games that occupy a strong position in the market, rather than those released by smaller independent companies.

2 See for example

The Ipsos MORI/Futurelab (2005) Teachers' poll discussed below

Kirriemuir, J (2002). A Survey of the Use of Computer and Video Games in Classrooms. Internal report for Becta (British Educational Communications and Technology Agency)

Kirriemuir, J (2005). Computer and Video Games in Curriculum-based Education. DfES

3 European Leisure Software Publishers Association **(www.elspa.com)**.

4 Forthcoming.

5 For example:

Becker, K and **Jacobsen, DM** (2005). Games for learning: are schools ready for what's to come? Proceedings of DiGRA 2005: Changing Views: Worlds in Play

Shaffer, DW (2005). Epistemic games. Innovate, 1(6) (available at **www.innovateonline.info/index.php?view=article&id=79**)

Gee, JP (2003). What Video Games have to Teach Us about Learning and Literacy. London: Palgrave Macmillan

McFarlane, AE (2003). Learners, learning and new technology. Educational Media International (Routledge) Vol 40 3/4

Kirriemuir, J and McFarlane, AE (2004). Literature Review in Games and Learning. Bristol: Futurelab Series (available online at **www.futurelab.org.uk/research/lit_reviews.htm#lr08**)

Fabricatore, C (2000). Learning and videogames: an unexplored synergy. Presented at the International Conference of the Association for Educational Communications and Technology, Denver, Colorado (available online at **www.learndev.org/dl/FabricatoreAECT2000.PDF**

Malone, T (1980). What Makes Things Fun to Learn? A Study of Intrinsically Motivating Computer Games. Palo Alto: Xerox

6 For example:

Game Studies **(www.gamestudies.org)** is an online journal dedicated to publishing the latest articles on research into all aspects of computer games.

Game Research **(www.game-research.com)** provides an overview of computer games research and development.

Games for Change **(www.gamesforchange.org)** provides support for organisations using digital games to effect social change.

Serious Games **(www.seriousgames.org)** promotes links between the games industry and projects involving the use of games in education, health, training and public policy.

7 In 2001, the British Educational Communications and Technology Agency (Becta: **www.becta.org.uk**) conducted a small-scale pilot study into the aspects of computer games that might support teaching and learning in schools (the report is available online at **www.becta.org.uk/research/research.cfm?section=1&id=2835**). This involved six schools reporting on their use of a variety of commercial computer games, for the most part in timetabled lessons. The report identified many strengths of using computer games but identified a number of factors that made their implementation problematic in a school environment. Teachers found that games led to increased motivation and high levels of engagement among students, as well as promoting ICT skills, fostering collaboration and stimulating discussion amongst students. They were also identified as contributing to the development of 'thinking skills' such as decision making, reasoning, enquiry and information processing. On a less positive note, many reported that games use didn't always fit easily into the constraints of a school timetable, sometimes appealed more to boys than to girls, presented technical difficulties that limited their effectiveness and in some cases distracted pupils from other aspects of the lesson.

Teachers Evaluating Educational Multimedia (TEEM: **www.teem.org.uk**), an independent evaluator of educational software, reported on the use of computer games in schools and the ways in which they might support the learning and teaching of curriculum content in 2002 (report available online at **www.teem.org.uk/publications/teem_gamesined_full.pdf**). Their study reached similar conclusions as the earlier Becta report, particularly highlighting the ability of games to foster collaboration between students, and the high degree of engagement seen when using games as a stimulus for learning. However, the study also drew attention to some of the barriers to using games in the classroom. In particular the discrepancy between the

content of games and the content of school curricula was seen to make it difficult for teachers to recognise the skills developed through using games within a formal learning context. The report suggests that this mismatch may be the "final obstacle" to using commercial games in schools.

Two other studies provide case study accounts of actual classroom use of computer games. In a US study S Squire (2004, 'Replaying History' PhD thesis, Indiana University - available online at **website.education.wisc.edu/kdsquire/dissertation.html**) describes using the game Civilisation 3 in history lessons, delivered in various contexts, including six weeks use in a high school's timetabled humanities lessons. S Egenfeldt-Nielsen (2005, 'Beyond Edutainment: Exploring the Educational Potential of Computer Games' PhD thesis, IT-University, Copenhagen - available online at **www.itu.dk/people/sen/egenfeldt.pdf**) provides an account of the use of the game Europa Universalis II in a Danish school to teach history over an eight-week period. Both studies generated rich accounts of pupils' actual use of games, based on researcher observation over extended periods of time. As in the UK studies, both suggest that the power of games to motivate and their ability to foster information-handling and problem-solving skills are qualities educators would find desirable in a teaching tool. However, they also highlight the constraints that occur as a result of the technical demands of the game. Each highlights in more detail the central role of the teacher, and examines some of the elements of gameplay that encourage learning (for example, Squire's "recursive play" or Egenfeldt-Nielsen's discussion of the place of player autonomy in encouraging motivation).

8 Twelve teachers were initially recruited to the project. Two additional teachers were recruited by participating teachers to assist, and two of the original teachers had to withdraw due to existing commitments. Fourteen teachers were therefore involved in the planning stages of the project, with 12 actually implementing lesson activities.

9 Ipsos MORI Teachers' Omnibus conducted between 4 and 25 November 2005.

10 Ipsos MORI Students Omnibus conducted between 24 February and 18 May 2006.

11 These criteria are discussed in greater detail in:

Sandford, R and Williamson, B (2005). Games and Learning Handbook. Futurelab: Bristol (available online at **www.futurelab.org.uk/research/handbooks.htm**)

12 According to Entertainment Software Ratings Board (ESRB).

13 According to Pan European Games Information (PEGI).

14 The report can be found at **www.ofsted.gov.uk/reports/index.cfm?fuseaction=summary&id=109283**

15 The report can be found at **www.ofsted.gov.uk/reports/index.cfm?fuseaction=summary&id=109384&bar=no**

16 The report can be found at **www.ofsted.gov.uk/reports/index.cfm?fuseaction=summary&id=126500&bar=no**

17 See **www.cabotcompetence.co.uk**

18 More information on the Royal Society for the Encouragement of Arts, Commerce and Manufacture (usually abbreviated to the RSA) can be found at **www.rsa.org.uk/rsa/index.asp.** Their Opening Minds project is described in more detail at **www.rsa.org.uk/newcurriculum**

19 See **www.specialistschools.org.uk**

20 Personal Development Curriculum.

21 The Student Research Groups (SRGs) were selected by the SMT to work with Futurelab researchers to identify the impact of games in the classroom from the student perspective. Three of the four groups were all male; one was all female. The students were from Year 10 or above. One group dropped out and one failed to finish their research before term end.

22 **McFarlane, AE, Sparrowhawk, A and Heald, Y** (2002). Report on the Educational Use of Games. TEEM (Teachers Evaluating Educational Multimedia): (report available online at **www.teem.org.uk/publications/teem_gamesined_full.pdf**)

Kirriemuir, J (2002). A Survey of the Use of Computer and Video Games in Classrooms. Internal report for Becta (British Educational Communications and Technology Agency).

23 Some of these lessons' locations on the diagram are due more to accident than design, with lesson plans being dictated to some extent by external circumstances. Teacher F, for example, was limited by the school's infrastructure to using a single machine with his class; his preferred approach would have been to have a machine for each student, enabling them to follow the internal narrative more closely, in which case his plans would have been represented better in the top right-hand quadrant.

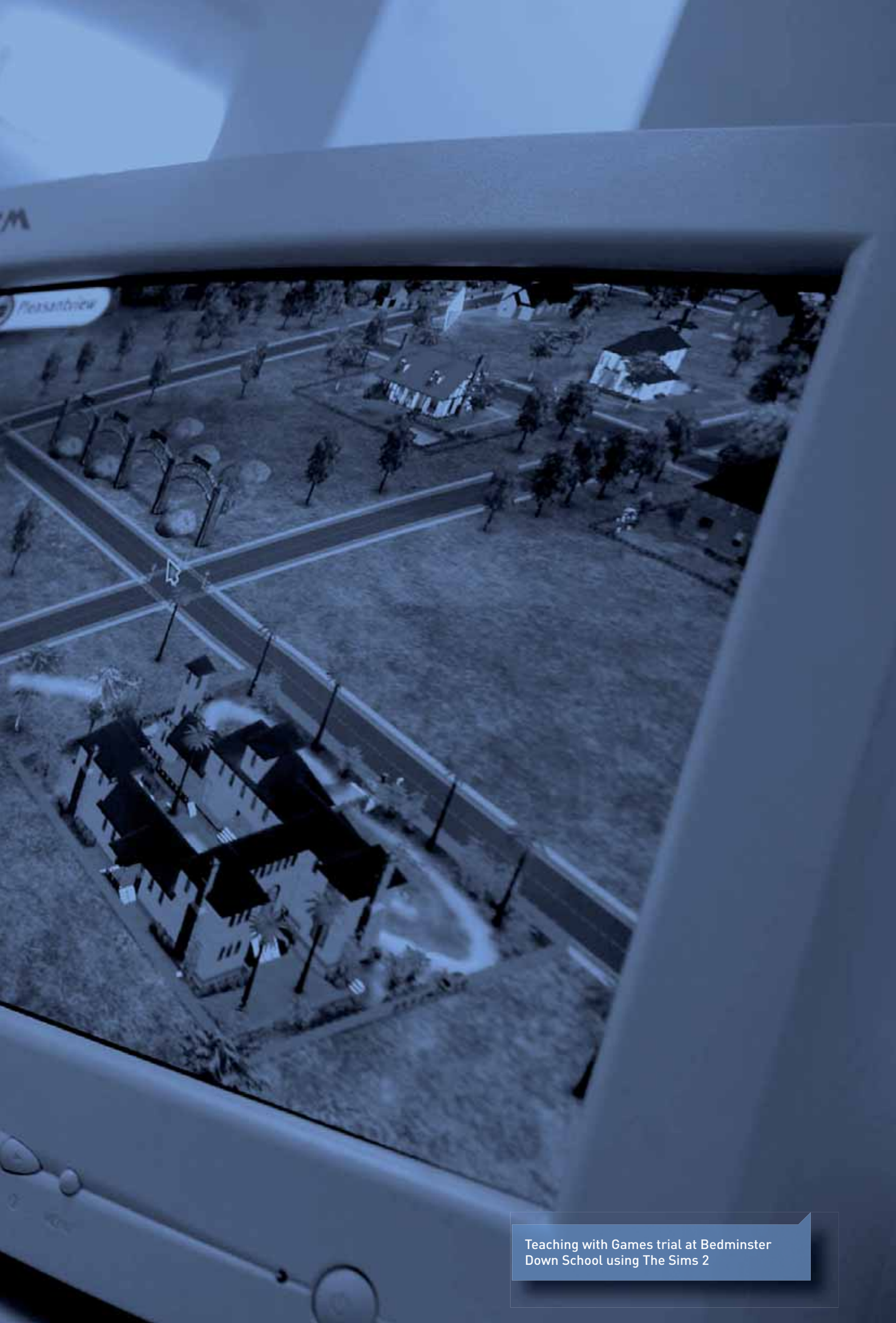
24 The customers in the theme parks of RollerCoaster Tycoon 3 are known as 'peeps'.

25 **Kirriemuir, J** (2005). Computer and Video Games in Curriculum-based Education. DfES.

26 The game was switched from Knights of Honor to The Sims 2

27 This can be found at **puzzling.caret.cam.ac.uk/pregame.php?game=10**

Open foldout pages to reveal
Appendix: summary of lesson plans



Teaching with Games trial at Bedminster Down School using The Sims 2

Appendix: summary of lesson plans

Teacher	Game	Subject game used in	Age	No. of lessons
A	KoH	Cabot Competency Curriculum	11-12	16 x 40 min lessons (8 double periods)
B	The Sims 2	Cabot Competency Curriculum	11-12	16 x 40 min lessons (8 double periods)
D&E	The Sims 2	Alternative Curriculum	11-12	5 x 60 min lessons
F	The Sims 2[26]	French	12-13	2 x 60 min lessons

Activities and lesson goal
Learning objectives: Improved group skills and decision making process, using information from different sources. **Activities:** Playing the game in teams taking set roles, session structured to include reflection and discussion time, processes recorded in journals. Game used as one resource for a presentation on medieval history.
Learning objectives: Improved teamwork, communication and information handling skills. **Activities:** In groups of four or five, taking set roles, building house for family (previously built by teacher) and guiding them through life decisions, recording processes and creative work based on the family's life in journals.
Learning objectives: Creative writing within a 'journalism' register, use of ICT tools such as Publisher, communication skills. **Activities:** Student experts created a Sims family. The management of these families (by an expert user) was projected on a screen to the whole class. Various activities based around students' observation of the Sims onscreen actions: write a news story about a virtual disaster that befalls the Sims family using the five 'Ws'... Who? What? When? Where? Why?; direct a Sim to a given location speaking German; describe characters of Sims in creative writing exercise
Learning objectives: Vocabulary acquisition and use within context. **Activities:** Students used internet to investigate typical French house (location, materials etc), then experts construct one in Sims following class instructions in French. Class wrote this up as a story.

Teacher	Game	Subject game used in	Age	No. of lessons
G	RCT 3	Design & Technology	11-12	10 x 60 min lessons (5 double periods)
H	RCT 3	Physics	11-12	9 x 50 min lessons
J	KoH	English	11-12	8 x 50 min lessons
K	The Sims 2	French	13-14	3 x 45 min lessons
L&M	KoH	Maths	15-16	3 x 45 min lessons
N	RCT3	Physics	17	6 x 45 min lessons (3 double periods)

Activities and lesson goal
Learning objectives: Understanding all aspects of the design process, improved group work, handling information. **Activities:** Researching theme parks using the internet and comparing results with the game, in groups of between three and six and as whole class planning specification for theme park based on research, in groups building theme park within RCT3 as well as external materials (promotional websites/leaflets).
Learning objectives: Understanding forces, making links between real world and theory, problem solving, identifying relationships. **Activities:** Completing game tutorial booklet; comparing RCT3 with simpler coaster simulator[27]; fixing coasters in RCT3 that don't work; sorting elements of theme parks using relational diagrams; building coasters to specifications; using the 'coastercam' on an interactive whiteboard, students acted out the influence of forces present when on a rollercoaster.
Learning objectives: Speaking and listening skills, independent and peer-led learning. **Activities:** Class playing game, directed initially by expert student then knowledgeable peers, supported by written work.
Learning objectives: Develop vocabulary and conversation skills in French. **Activities:** Using the game as a stimulus, students discussed similarities and differences between Sims' and their own life, in French.
Learning objectives: Building strategic thinking and teamwork skills. **Activities:** Playing the game in groups of four, recording decisions.
Learning objectives: Understanding concept of conservation of kinetic and potential energy. **Activities:** Pairs of students playing 12 scenarios, created by teacher, initially raising awareness of factors that influenced coaster performance, and eventually used to deduce the law of kinetic energy through analysis of graphs produced.

This publication is available to download from the Futurelab website – **www.futurelab.org.uk/research/teachingwithgames/findings.htm**

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Futurelab's handbooks draw on a range of research, literature and knowledge developed through in-house research and development programmes in order to provide insights and guidance regarding the use and development of new technologies and new approaches to education.

Opening Education Series
Focusing on emergent ideas in education and technology, this series of publications opens up new areas for debate and discussion.

Front cover images from left to right:
Teaching with games at Bedminster Down School using Rollercoaster Tycoon 3
Teaching with games at Bedminster Down School using Knights of Honor
The Sims 2 - EA

Futurelab is passionate about transforming the way people learn. Tapping into the huge potential offered by digital and other technologies, we are developing innovative learning resources and practices that support new approaches to education for the 21st century.

Working in partnership with industry, policy and practice, Futurelab:

- incubates new ideas, taking them from the lab to the classroom
- offers hard evidence and practical advice to support the design and use of innovative learning tools
- communicates the latest thinking and practice in educational ICT
- provides the space for experimentation and the exchange of ideas between the creative, technology and education sectors.

A not-for-profit organisation, Futurelab is committed to sharing the lessons learnt from our research and development in order to inform positive change to educational policy and practice.

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