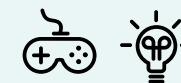




The impact of console games in the classroom: Evidence from schools in Scotland

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in partnership with Futurelab.



Declaration

The views contained in this report are those of the authors and do not necessarily represent the views of Learning and Teaching Scotland.

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This research was commissioned by Learning and Teaching Scotland (LTS) in partnership with Futurelab. The main focus of the project was to identify the educational benefits of console game-based learning in primary and secondary schools. The project also sought to understand how the benefits of educational gaming could transfer to other settings and, in particular, how the model of the Learning and Teaching Scotland Consolarium – the national centre for games and learning that explores and supports game-based learning (GBL) in the classroom – could be modified, extended or enhanced. For this purpose, research was carried out in classrooms in Scotland to explore learning with games played on games consoles, such as PlayStations, Xboxes and Wiis. Interviews were carried out with school leaders, classroom teachers and students in 19 schools followed up by a series of lesson observations in four of these schools.

Key findings

Drawn from all phases of the research – senior leadership and teacher interviews, student focus groups, and classroom observations – key findings of the project are:

- Game-based approaches present an excellent opportunity to engage students in activities which can enhance learning and produce a range of educational benefits;
- Game-based learning approaches need to be well planned and classrooms carefully organised to engage all students in learning and produce appropriate outcomes;
- Game-based learning approaches build on many children's existing interests, skills and knowledge and can narrow the gap between children's home and school cultures;

- Game-based learning approaches can increase communication between parents and teachers and school leaders and enhance parental engagement in children's learning;
- Teachers often have to overcome a number of barriers and reservations about using game-based learning approaches in classrooms, however when they do so, they are convinced of the results;
- Game-based learning approaches have the capacity to increase teacher motivation;
- Teachers need support, from peers, school leadership and outside resources, in order to use games well for learning and mediate them effectively;
- Resourcing game-based learning approaches can be difficult. Further support would be beneficial;
- Curriculum for Excellence is seen by the people interviewed for the study as an opportunity to try out new things such as game-based learning complemented by emerging Assessment is for Learning criterion.

Summary of findings from the interviews with school leaders

The interviews with school leaders found that:

- School leaders were well informed and very enthusiastic about the role of game-based learning in schools and perceive many benefits for teachers as well as students – including harnessing children's current culture, engaging and motivating children and preparing children for future life;

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- Schools have usually become involved in game-based learning through contact with the LTS Consolarium;
- School leaders face a number of barriers in encouraging game-based learning in their schools which include resourcing issues and teachers' initial reticence to get involved;
- School leaders believe that the principles underpinning Curriculum for Excellence will provide new opportunities for learning;
- School leaders believe that changes in teaching and learning in schools are attributable more to Curriculum for Excellence and the development of active and interdisciplinary learning rather than game-based learning approaches.

Summary of findings from the interviews with classroom teachers

The interviews with classroom teachers found that:

- Teachers may have had initial reservations about trying out game-based learning, but those who did, believed it enhanced learning;
- Teachers who participated in game-based learning indicated it engaged and motivated their students to a significant extent;
- Many of the teachers were not experienced with the games but allowed their students to guide them with the technology;
- Teachers were prepared to alter their classroom practices to incorporate game-based learning activities;

- Many of the teachers accessed and valued the support systems coordinated by Learning and Teaching Scotland, local authority teams and the LTS Consolarium;
- Many of the teachers were willing to share their practice with others and believed that more teachers should incorporate game-based learning approaches with their students.

Summary of findings from the interviews with students

The interviews with students found that:

- Students perceived a range of educational benefits as a result of participating in the game-based learning approaches, including increased collaboration, creativity and communication;
- Students' responses in general showed how positively they viewed console games and the projects built around them in school;
- Some students found aspects of the projects repetitive, others believed that game-based learning should be included in the curriculum as part of a balance between new and more traditional learning experiences;
- In some classrooms, students found other students playing games whilst they were trying to work distracting.

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Recommendations

The following recommendations have been developed through careful consideration of the findings from all phases of the project.

For policy:

- Policymakers should encourage and support schools to introduce well-planned game-based learning initiatives into classrooms;
- Policymakers should ensure that flexibility is available within the curriculum and assessment regime to ensure that game-based learning can be accommodated;
- Policymakers should ensure that school leaders and teachers are reassured that game-based learning approaches fit with the aims of Curriculum for Excellence;
- Policymakers should continue to support and, where possible, increase the support given to schools in order to encourage game-based learning approaches.

For school leaders:

- School leaders should encourage and support classroom teachers to introduce well-planned game-based learning initiatives into classrooms;
- School leaders should acknowledge that game-based learning approaches present a new challenge for many teachers and they need to be well supported;
- School leaders need to continue to work alongside parents for them to understand the educational benefits of game-based learning and to be able to support their children with this.

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There has been much interest in the potential of console games¹ for learning and teaching in recent years. They are popular with young people - a recent survey carried out for Futurelab showed that 79% of 737 children aged five to 15 played computer games at home alone 'at least a few times a week' (Ulricsak and Cranmer, 2010). At the same time, a growing number of research studies show that there are educational benefits to be derived from gaming in classrooms and, informally, at home. Playing computer games at school is seen to be one of a number of technologically oriented activities which can overcome what has been referred to as the 'digital disconnect' whereby children engage in rich and extensive uses of Information and Communication Technologies (ICTs) at home but this knowledge and experience is then kept outside of the school gates (Buckingham, 2007).

Learning and Teaching Scotland (LTS) — a non-departmental public body sponsored by the Scottish Government Schools Directorate — is the lead organisation for curriculum development in Scotland and offers support and guidance to teachers, early years practitioners, schools and education authorities to help improve achievement for all. In response to these issues, Learning and Teaching Scotland were keen to explore the benefits and possibilities of using computer games in schools and to support innovative practices, so in 2006 it established the Consolarium—a game-based learning centre in Dundee. This centre's aims were to:

- Explore the range of games technologies available and in doing so practically and theoretically inform and influence new curriculum developments and approaches to pedagogy;

- Provide a place where education managers and others involved in education could visit and get hands-on access to a range of GBL resources;
- Act as a catalyst to encourage teachers and educators to begin to engage with the debate about the place of such technology in their class, school or local authority; and
- Develop relationships with academic and industry partners to explore and articulate what effective GBL and practice and resources looked like.

This led to a number of LTS Consolarium supported projects in schools in almost all of the 32 local authorities across Scotland. The centre has worked with many teachers to adapt or 'retro-fit' commercial off-the-shelf games for nursery, primary and secondary schools. Some examples include Dr Kawashima's Brain Training and Nintendogs (Wastiau et al. 2009).

The main focus of the Impact of Games in the Classroom project was to identify the educational benefits of game-based learning in schools. For this purpose, research was carried out in classrooms in Scotland to explore learning with games played on games consoles, such as PlayStations, Xboxes and Wiis. The project also sought to understand how the benefits of educational gaming could transfer to other settings and, in particular, how the LTS Consolarium model could be modified, extended or enhanced.

Curriculum for Excellence² will be introduced at the start of the school year 2010-2011. The new curriculum has been designed to ensure that children and young people have a seamless transition

¹ The term 'console games' is used in this report to describe video, computer and digital games of any genre played on games consoles such as Xboxes, PlayStations and Wiis.

² See <http://www.ltscotland.org.uk/curriculumforexcellence/index.asp> for the Curriculum for Excellence website.

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through the different stages of their education from the age of 3 to 18. It has been developed around four main capacities, to enable each young person to be **a successful learner, a confident individual, a responsible citizen and an effective contributor.**

Learning with and about technologies is embedded across all subjects in the curriculum and the ability of computer games to support the development of skills and knowledge has been highlighted. As a result, LTS commissioned this research in partnership with Futurelab. The report will firstly introduce the area of game-based learning through a summary of the literature, introduce the methods that were used for the collection of data, and then report on interviews with school leaders, teachers and students in discrete chapters followed by four case studies to give in-depth examples of the kinds of approaches taken in four schools in Scotland. These outputs will then be further analysed to produce a taxonomy of educational benefits of gaming in schools, a summary of the specific challenges and opportunities as raised in the interviews and, finally, recommendations for the further development of educational gaming strategies and policies in the UK (aimed at policy and school leadership audiences).

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Summary review of the literature: games and learning

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Digital games have made their ways into classrooms over the past several decades. While the types of games and instructional approaches with them have varied, there has been a considerable increase in attention and analysis of their use for pedagogical purposes in the last several years. This literature review summarizes the notable documents from this discourse, looking at learning theory, impact and outcomes, and challenges as pertinent to the lens of console game-based learning. Section 3 of the report concludes the literature review by looking at effective teaching methods and approaches for game-based learning.

The genre of digital games spans a large spectrum of technologies, including video or console games (such as those played on the Sony PlayStation or Nintendo Wii), computer games (those played on a PC), and handheld gaming (such as the Nintendo Game Boy or DS). The types of games for these platforms can vary considerably - from drill-and-skill games to action/adventure immersive worlds. Appendix 2 describes the general categories of games available. It should be noted that these categories are not necessarily discrete and several of these genres would apply to games considered 'edutainment' - applications designed for leisure with an educational component built in.

The popularity of games in mainstream culture has spurred many to question how games might be used to engage young people inside the classroom. Efforts to harness the motivational power of games have resulted in the emergence of the edutainment industry - games specifically designed to help individuals learn specific content and skills. Unlike their 'big brother', commercial off-the-shelf games designed for leisure and entertainment, learning-oriented games tend to be more simplistic as their development budgets are often not nearly as high. Yet this has been considered the secondary reason for the minimal success of the edutainment games.

One of the biggest downfalls of this genre is that the learning objective is quite evident to the learner and often doesn't have much meaning for the learner; however, in more robust, interactive learning games, the learning objective is submerged in a rich world that creates learning opportunities (Ahuja, Mitra, Kumar & Singh, 1994). This latter type of learning game is much less prevalent than the former, which has resulted in an overall negative stereotype to the learning games industry (Klopfer, Osterweil & Salen, 2009).

Game-based learning

Despite the mixed success of games designed specifically for education, the impact of commercial digital games has drawn many educators and researchers to question how they might be used to facilitate student learning. Over the past decade, the use of digital gaming in education has prompted considerable attention in exploring how and why games might be powerful tools in the classroom. As a result of this interest, there is a considerable body of literature available on game-based learning in the classroom and the potential benefits of this for education and learning. This report has drawn on a number of these studies to provide a context for the overall project.

By the term console gaming we are referring to specialised computer devices used to play video games where the player interacts with the unit via an external controller or joystick. Examples include the Microsoft Xbox, Sony PlayStation and Nintendo Wii.

Learning theory, as it relates to games

The vast array of games that learners can engage with presents multiple dimensions in which games engage learners. How these games are designed, as well as how they are implemented in the

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classroom, can be organized as to how they relate to learning theory (Egenfeldt-Nielsen, 2006; Kirriemuir & McFarlane, 2004):

Behaviourism: A view of learning, which occurs through reinforcement to stimuli and response. Games designed on this learning principle generally present the player with a task or skill to be repeated until mastered or conquered, receiving rewards after attainment. Those games considered drill-and-skill edutainment often fall into this category. Since these tasks are extrinsically motivated, learning is seen as transmission rather than construction (Good & Brophy, 1990). As such, the critique of this type of game is that it is considered training, rather than the acquisition of deep understanding or skill content – leaving opportunity for learning transfer unlikely.

Cognitivism: In this learner-centred view of learning, the individual actively constructs their understanding in learning experiences. Discovery and inquiry-oriented games fall into this category, where learning and play are integrated to provide a context that allows for the active construction of knowledge. Intrinsic motivation is more often associated with these games, with problem-solving as one of the key meta-skills employed (Egenfeldt-Nielsen, 2006).

Constructionism: Akin to the cognitivist perspective but places emphasis on the external tools used to construct knowledge. This is most associated with the gaming and simulation platforms Logo and StarLogo.

Social-Cultural: This perspective views learning not as the acquisition or construction of knowledge, but rather the 'tool that mediates activity'. In this way, learning is considered to be situated and therefore the activity becomes the unit of analysis (Egenfeldt-Nielsen, 2006, p. 199). Example titles include Civilization and SimCity. The rich social context that surrounds this game-play is

considered to be one of the greatest aspects to game-based learning and as a result, the game is the tool that creates a viable learning experience.

Looking at digital games through these lenses is useful for understanding why and how they may be implemented in learning environments.

The argument for game-based learning

Attempting to promote games for education and learning purposes has prompted considerable attention over the past decade. The tremendous variety of digital games available has provided much for educators and researchers to explore, resulting in many arguing that many games have benefits both in and out of the classroom for learners of all ages.

A recent Futurelab review of games and learning has provided a broad overview of the components, benefits and challenges to game-based learning. This report identified two key themes for pursuing the development of games for education (Kirriemuir & McFarlane, 2004):

- The desire to harness the motivational power of games in order to 'make learning fun';
- A belief that 'learning through doing' in games such as simulations, offers a powerful learning tool.

These findings frame the three key aspects to game-based learning: **motivation, skill development, and immersive learning environments.**

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Motivation

Engagement and motivation have long been established as clear outcomes of using games in the classroom (Joyce, Gerhard & Debry, 2009). The very nature of games provides three main factors for motivation: fantasy, challenge and curiosity (Malone, 1981). These facets connect with our understanding of child development:

- Fantasy relates to the use of imagination and the child's inherent inclination towards play (Opie & Opie, 1969). Unstructured play, be it with dolls, Lego bricks or video games, was seen by Vygotsky as a powerful learning tool (Vygotsky, 1978). Klopfer et al explain that play creates a learning space along five distinct axes (2009):
 - freedom to fail
 - freedom to experiment
 - freedom to fashion identities
 - freedom of effort and
 - freedom of interpretation.

These dimensions create a learning space where new ideas and problem-solutions can be tested and retested because failure is not only accepted but expected, where a new identity can be tried on and embodied, where it's ok to try hard at times while being more relaxed at others, and where one is learning about the game while learning with the game (Klopfer et al, 2009).

- Challenge is created by the task or puzzle in the game and when appropriately aligned with the child's ability level, the challenge falls within their zone of proximal development (ZPD) — the Vygotskian term for the developmental level of a given skill for a learner, where the task at hand is challenging enough to encourage growth through minimal scaffolding, without being so difficult that the learner is unable to achieve the task. Vygotsky saw this as a critical space, where deep learning and construction of knowledge can occur (Vygotsky, 1978). Study of children's

game-play has demonstrated that this is critical to game enjoyment - the game must be neither too difficult nor too easy (McFarlane et al, 2002).

- Curiosity here is meant in the sense of testing the game, or exploring to determine 'what happens if I do this' – which, again, aligns with the nature of play and how children use safe spaces to explore and experience their world.

These aspects of games make them motivational at a cognitive level. Digital games then also have the added allure of sharp graphics and new technologies that are a greater part of children's everyday lives. These elements make learning based on and integrated in games and game play highly motivational, and creates the aforementioned 'play space' where students can engage in rich learning opportunities through exploring, experimenting, fashioning, interpreting and failing.

Skills

The exact skills generated as a direct result of game-play, both casually and strategically in learning environments, are still debated. However, there is increasing evidence of the development of skills and competencies.

A critical review of the potential of digital education games conducted for TEEM - an organisation that evaluates educational software - using teacher evaluators of mostly simulation and quest-based games found numerous skills to be developed through their use (McFarlane, Sparrowhawk & Heald, 2002):

- Strategic thinking;
- Planning;
- Communication;
- Application of numbers;

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- Negotiating skills;
- Group decision-making;
- Data-handling.

A recent large-scale review of educational gaming in schools surveyed over 500 teachers across Europe and has reinforced these findings, citing that beyond increased motivation, teachers using games in the classroom have also noted improvement in several key skills areas (Joyce, Gerhard & Debry, 2009, p. 85):

- Personal skills (such as initiative and persistence);
- Spatial and motor skills (such as coordination and speed of reflexes);
- Social (such as teamwork and communication);
- Intellectual (such as problem-solving).

The Education Arcade has also examined case studies and analyses of the games I Love Bees and Civilization, which demonstrate the higher-order cognitive skills of collaboration and collective intelligence, as well as analysis and complex argument (Klopfer et al, 2009). Additionally, strategy and adventure games have been purported to develop logical thinking and problem-solving skills as the player adopts a trial-and-error approach to overcoming challenge-scenarios in the game (Higgins, 2000; Malone, 1983).

It is important to note that some games cultivate these skills by just engaging with them, such as in the case of I Love Bees where challenges cannot be solved without collaborating and leveraging knowledge of other players. Other skills are likely to be developed through the way in which the teacher implements the game in the classroom; for example, many games can be played alone, however if they are played in (or amongst) groups, it creates a space where skills like negotiation and communication become critical.

Games as rich environments for learning

Many argue that these skills are able to be accessed because many games provide such rich learning environments that surround learners:

“Games allow players to enter environments that would be impossible to access in any other way, eg going back in history, understanding the complexity of running a major city, managing entire civilisations or nurturing families. They require engagement with complex decisions – exploring the effects of different choices and a multiplicity of variables. They offer ongoing and responsive feedback on choices – calibrating closely to the ability level of the individual and then encouraging them to discover new limits to those abilities. They stimulate conversation and discussion; players share ideas, hints and tips in what increasingly tend to be lively and supportive learning communities.” ELSPA, 2006, p.5

James Paul Gee, a leading researcher and theorist in educational gaming, has deconstructed what he believes to be the critical dimensions of digital games, which make them powerful learning environments. One of Gee’s central arguments is that digital games create ‘semiotic domains’ which are “any set of practices that recruits one or more modalities (eg, oral or written language, images, equations, symbols, sounds, gestures, graphs, artefacts, etc) to communicate distinctive types of meanings” (Gee, 2003, p. 18). The **semiotic domain** for a game is the world or culture it creates and is shared by those participating in the game together; in this world, participants share knowledge, skills, experiences and resources. Active and successful participation in a semiotic domain is demonstrated by ‘active learning’, where group members gain the resources and skills to solve problems within, and perhaps beyond, the domain, as well as ‘critical learning’, which includes thinking about the game at a ‘meta’ level so that they cannot only operate

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within the game but within the social structure that surrounds the game as well (Williamson, 2003).

Console games

The popularity of console and handheld games in recent years has tended to “redefine the nature of games, opening up the possibility for new kinds of games in the marketplace and putting powerful and inexpensive platforms in the hands of tens of millions of people,” (Klopfer et al, 2009, p. 8). The affordability and low-technical barriers to console games, as well as the portability of handheld consoles, have put video gaming in many of the homes of today’s learners. This ease-of-use has also led to lower barriers to implementation in the classroom (Faux, McFarlane, Roche & Facer, 2006).

While many of the arguments and evidence discussed here have either included console games and/or are connected through games that have been created for game consoles, research directed specifically at the use of console games in the classroom is limited. However, initial studies of the use of brain training console games have demonstrated positive effects; for example, a study of 71 primary school children (10–11 years old) which examined the effects on mathematical computation and self-perceptions after a ten-week period using console-gaming, demonstrated significant gains in both skills as compared to the control group (Miller & Robertson, 2009). A larger-scale (634 students) follow-up study to this was conducted using a brain-training console game, which found that while both the control and treatment groups showed considerable gains, the treatment group demonstrated over 50% greater accuracy and twice as fast response times (Miller & Robertson, in press).

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Using games in the classroom

The vast array of digital commercial-off-the-shelf games provides the opportunity to use them in a variety of educational ways - depending on the nature of the game and the strategy for its use in the classroom (see Figure 1).

As described previously within the account of the socio-cultural view of learning using games, much of the learning experience resides beyond the boundaries of the game. More research is needed in order to understand the richness that is embodied by the socio-cultural dynamic that can be generated by game-based learning. However, one example of an effective pedagogy is present in the use of external notebooks and learning logs that can accompany the game-play. In studying classroom use of the PC game *Global Conflicts: Palestine*, researchers found that students using paper and pencil were able to use these tools to actively construct their knowledge in the game, and the artefact could then be used in other areas of teaching (Buch & Egenfeldt-Nielsen, 2006).

The TEEM report found that one of the primary uses of games in today's classrooms is to stimulate discussion, writing and collaboration. Many educators use games as the core within a wider set of activities relating to the context or subject under discussion (McFarlane et al, 2002). However, many games are rich, immersive worlds as Gee described earlier, which can be used in various ways as 'learning systems' - such as drawing on the games' content-generating aspect or by building classroom structures around the game, such as reflection and discussion, using the game as the context (see Figure 1).

The importance of the teacher

Teachers are also consistently found to be critical components in effective game-based learning. Where the game is just the tool, the teacher is essential to effective implementation of the game through direction of the learning approach, discussion and debrief, and the support in construction of the social learning culture that surrounds the game-play. However, this does not always come intuitively and often educators need support in understanding how to ensure that the use of games in class is effective (Sandford & Williamson, 2006).

Strategies for effective game-based pedagogy

The strategies offered by games as depicted in Figure 1 are quite diverse and play out differently in classroom practice. However, there are some central strategies that promote successful implementation of games for learning in the classroom.

A recent Futurelab report, *Teaching with Games: Using commercial off-the-shelf computer games in formal education* (Sandford, Ulicsak, Facer & Rudd, 2006), provides several suggestions for teachers and schools, including:

Classroom practice

- Be clear about the learning objectives that learners are intending to achieve over the course of the work.
- Use games as appropriate: they do not have to be used in their entirety in order to achieve educational goals and stimulate motivation. Certain game aspects can be extracted or isolated from the game as a whole.
- Allow for sufficient time for both you and your students to become familiar with the game.

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Games as learning systems

Games as authoring systems (generating artefacts) - Using games to construct an artefact, for which a rubric can be generated to assess the learning and skill development of each learner (such as building a city in SimCity or a creature in Spore).

Games as content systems (content) - The game provides specific content to help deliver understanding in that curriculum area (such as marine life in Endless Ocean or urban planning in SimCity).

Games as manipulating systems (simulations) - Some games create dynamic, complex systems in which the player can interact with and test the principles of these systems (such as building a working rollercoaster in RollerCoaster Tycoon and trying physics-based theories with Soda Play).

Games as trigger systems (content) - Games can be used to create a scenario or experiential context for understanding around a topic, issue, or principle that a teacher can build on; in this fashion, the game is the theme upon which classroom enquiry is built.

Games as gateway systems (learning technology) - In this way, the focus is the technology and providing learners with the opportunity to learn a specific platform or how to use a specific device (such as learning how to use game-authoring tools like Scratch or how to use a mobile device like a Pocket PC).

Games as reflective systems (illustration) - Teachers can use the context for decision-making and as a way to discuss why decisions were made in a certain way, or other reflective aspects of the game.

Games as point-of-view systems (perspective) - By taking on an avatar and new identity in the game, a teacher can use the game to develop perspective in students and ask them to re-play the same scenario choosing different avatars and roles to gain an understanding of different perspectives.

Games as code systems (programming) - In this context, writing is the primary mechanic and artefact of game-play, which can then be assessed to capture student understanding.

Games as documentary systems (documentary) - Games can be used to document evidence of student ideas and understanding. For example, storyboarding with screenshots can be used to capture the details of a game situation, which then can be used as the basis for additional discussion or reflection.

Games as ideological systems (text) - Rich game scenarios can be 'read' as texts that express certain underlying ideologies, values, beliefs, etc. Games used this way can provide students with opportunities for reflection on and discussion in spaces external to the game.

Games as research systems (research) - Research skills and methods can be taught in scenarios where students are tasked with designing games and are required to consider what players will be learning from their games, how this affects credibility and point of view, etc.

Games as assessment systems (evaluation) - Certain games afford the opportunity to use the game as an environment where learners can demonstrate their understanding (such as successfully playing Quest Atlantis to demonstrate acquisition of certain science concepts).

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- Reflection time must be purposefully structured into lesson plans and class time, as well as contingency plans set aside for technical issues.
- Encourage students to be the trainers and leaders in implementation of the game; they will be the experts in the game rules and content, and taking this leader/educative role helps generate the 'community of learners' dynamic in the classroom - critical to creating a culture of enquiry.

Schools

- Teacher support is essential — from technical staff as well as other teachers working with game-based learning.
- Greater flexibility in timetabling and lesson organisation can be helpful in supporting teachers to explore the full potential of working with games over longer periods of time.
- Encouraging a larger culture of collaboration and providing the means to support professional collaboration with peers is critical to supporting the growth of a larger game-based learning culture in the school.

Additional successful strategies noted by others include engaging students in collaborative play in pairs and in small groups, followed by whole-group discussion (Klawe & Phillips, 1995).

Evaluation and assessment also need to be able to capture the richness of the learning experience; this means allowing students to demonstrate learning outcomes through essays, presentations, multimedia artefacts and portfolios (Gee, 2004).

Challenges to game-based pedagogy

Practitioners and researchers have cited several barriers to fitting game-based learning into the classroom including short lessons, physical space, variations in game competence among students,

installation, costs, and teacher preparation time (Egenfeldt-Nielsen, 2006). Obstacles to game-based learning most frequently cited (adapted from Kirriemuir & McFarlane, 2004 and Klopfer et al, 2009) include:

Curriculum

- The challenge for teachers to identify how a certain game would connect to the curriculum.
- Difficulty with integrating the play of the game into the time structure of the day, often in 45-min classes.

Game related

- The challenge for teachers to identify the accuracy and appropriateness of the content of the game.
- Irrelevant or distracting content from the game that could not be removed.

Attitudes

- The challenge in persuading other school stakeholders to the value of the game in the classroom.

Teacher support

- Lack of available time for teachers to learn the game and generate best practices with it.
- Lack of specific training and support on the effective use of games in the classroom.

Assessment

- Traditional assessments do not often align with game-based learning, so new models and approaches must be considered.

From a general perspective, the 'grammar' of games - the structure and modus operandi of games - is often in direct contrast to the classroom environment, where the spirit of play

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is uncomfortable in many classrooms. Likewise, there is a rub in logistics of game-play with a traditional 'linear' curricula where learners are progressively exposed to topics in each discipline (Klopfer, Osterweil & Salen, 2009).

Supporting teachers and effective game-based learning

For traditional schools, console games as well as game-based pedagogy are distinct innovations to be accommodated. Such innovations have considerable challenges and barriers and often need certain supports in order to go beyond the successful implementation of the lone teacher and become effectively adopted by a learning environment (Kirkland & Sutch, 2009; Groff & Mouza, 2008).

Teachers are indeed the key to effective game-based pedagogy. Supporting their growth in practice is critical to a sustainable and enriching use of game-based learning in a classroom, school or education system. Teachers have demonstrated their need for peer support, as some game-based learning researchers are finding that teachers are organising themselves into communities of practice — using online collaboration and social networking to share insights, resources and supports for being successful with game-based learning (Joyce, Gerhard & Debry, 2009).

Future directions for understanding game-based learning

While the research into game-based learning shows some positive results, leaders in the field have noted that studies conducted thus far leave a margin of scepticism due to lack of control groups, researcher bias, weak assessments, and short exposure time (Egenfeldt-Nielsen, 2006). Further research is required that

accounts for these variables and which better examines game-based learning, and the various approaches to it, directly against other traditional pedagogies and teaching styles.

As noted earlier, given the popularity of games and the potential for learning that this may present, considerably more research is needed to understand the nature, effects, strategies and outcomes of this pedagogical approach.

Summary of literature review

The burgeoning field of game-based learning has demonstrated considerable effects on learning and classroom practice. The opportunity afforded by many games is summarized by Klopfer et al (2009, p. 1):

“...game environments enable players to construct understanding actively, and at individual paces, and that well-designed games enable players to advance on different paths at different rates in response to each player's interests and abilities, while also fostering collaboration and just-in-time learning.”

Many games have been shown to be robust educational tools — both inherently by their design as well as their effective implementation in the classroom. Thus far, research on the impact and outcomes of this pedagogy is somewhat limited but promising. Further projects and evaluations are needed to provide the support needed to encourage more teachers and schools to adopt these practices, if indeed the early results are to be confirmed in further studies. Additionally, further analysis of effective classroom strategies and pedagogies, as well as effective external supports for game-based learning, are needed to make this innovation scalable.

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Given our research questions, it was decided to adopt a multi-method qualitative approach in order to study game-based learning within its typical contexts, schools and classrooms. Firstly, two researchers visited 19 schools (one nursery, ten primary, eight secondary) to carry out interviews with school leaders, teachers and students (from primary to S5) followed by return visits to four of the schools to undertake detailed classroom observations (see Appendix 1 for a description of the sample schools). All visits took place between April and July 2010. Table 1 shows the number of participants in each category.

School leaders	Teachers	Students
19	48	150

Table 1. Description of sample

The schools were selected in association with the LTS Consolarium on the basis of whether or not they had recently undertaken a game-based learning initiative. As the focus of the project was to investigate the benefits of games for education and learning, it was decided only to visit schools where such initiatives were underway and could be explored. This led to the slight dominance of primary schools within the sample where more game-based learning approaches were reportedly underway. The schools selected for return visits were chosen according to several criteria, which included the range and richness of the initiatives underway combined with the practicality of whether such programmes of work were running when the researchers were available to visit. The selection was also influenced by whether the school could accommodate the researchers given that the summer term was drawing to a close and school trips and other activities were underway. Unfortunately, we were unable to identify a secondary school for a return visit due to timetabling issues and the fact that

secondary schools were using game-based learning approaches much less in general. This highlighted a general problem, also reflected in the data, that it is much more difficult to sustain game-based learning initiatives in secondary schools, mainly due to the organisation of the curriculum.

Using a multiple method or 'triangulated' design was intended to highlight the different dimensions of game-based learning from the different perspectives of school leaders, teachers and students. This allowed for the validity of the findings to be strengthened by the corroboration of data collected in a variety of ways (Rosenblatt & Fischer, 1993). School leaders and teachers were interviewed individually and group interviews were carried out with students mostly in clusters of three or four. Semi-structured interviews were conducted to allow respondents to talk about their own perceptions of game-based learning, raise their own issues in relation to this and explain their viewpoints in their own words (Copeland & White, 1991).

Observational data was collected to ensure that game-based learning could be explored in situ and also to counter growing reservations about the reliability of self-reporting in interviews (Buckingham et al., 2005). Questions were designed to explore the benefits, opportunities and challenges posed by game-based learning approaches in classrooms, the impact on teaching and learning, the organisation of the curriculum, and the activities themselves.

The interviews were all digitally recorded and then either transcribed or systematically noted and written up afterwards to ensure that all data was taken into account. Observational data was collected via a pro forma, which was completed by hand in situ and then written up afterwards. Data was analysed according to what Strauss refers to as 'constant comparison' (Strauss, 1987). All texts were read to get

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an overall sense of the data and an initial code list developed and refined to directly relate to the research questions outlined above. The data were then coded in terms of these categories and reports structured accordingly.

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The school leaders interviewed ranged from those who are new to game-based learning to those whose schools have been using console games for three years. The great majority are well-informed and very enthusiastic about the role of game-based learning in their schools and perceive many benefits, for teachers as well as pupils. In some schools they have just begun to initiate game-based learning projects but in many cases school leaders have been actively involved in developing and embedding game-based learning in their schools.

How and why do schools get involved with game-based learning?

Schools became involved in game-based learning for a variety of reasons but in most cases, interest in games based learning was triggered by involvement with the LTS Consolarium. Across the schools visited, there were typically three types of implementation.

An enthusiastic lead teacher

The majority of projects have come about because an enthusiastic and well-informed teacher with an interest in game-based learning has approached their head or principal teacher. In some cases these have been pilot projects offered by LTS or by the local authority (often in partnership with LTS) but in others they have come about because the teacher has become aware of game-based learning through their own professional reading and development. The LTS Consolarium and LTS websites have played an important part in this awareness-raising and often teachers have been to conferences or meetings where presentations or case studies have made them want to find out more. In two cases, the lead teachers have migrated from other schools where they have been part of a game-based learning culture.

An external pilot project

Pilot projects were established through a variety of ways:

- LTS has approached schools directly via headteachers or teachers who have expressed an interest at conferences;
- LTS has worked in partnership with the local authority who have contacted schools known to them;
- LTS has drawn on personal and professional contacts to set up projects with colleagues who are already aware of game-based learning.

A headteacher initiative

In a small number of cases, the game-based learning projects have come about because headteachers themselves view it as a priority. Typically they were inspired by attending a conference, course or meeting where a presentation was made by the LTS team; this would lead to them identifying a key practitioner to take things forward and becoming involved in one or more pilot projects. In one case, a headteacher had been wondering for some years whether game-based learning was the way forward for his school; inspiration came from a Christmas present - actually playing Little Big Planet at home on the PS3 with his family revealed unexpected potential and led to the rapid development of a whole school initiative to implement game-based learning. Another head's experience was quite different:

"It hasn't been a great dawning of light for me, it's just been a natural process - 'what will tap into children's own interests?' and 'let's try this move it on from there'"

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Reasons for adopting game-based learning

School leaders readily identify a variety of reasons for adopting and sustaining game-based learning:

- **Implementing Curriculum for Excellence:** one primary headteacher stated: “This [game-based learning] is real learning ...Curriculum for Excellence...it’s about that enriched learning environment.” Most of the school leaders can see a valid place for game-based learning within Curriculum for Excellence, although some secondary leaders have concerns about how this will fit with assessment requirements at levels four and five (approximately S3-S6, ages 14-17).
- **Harnessing the children’s current culture:** most of the school leaders involved felt that gaming is an important part of pupil culture which should be recognised by the educational system and harnessed to engage pupils in learning. One senior leader commented: “The quality of images, high speed delivery and the stimulation - that’s their life at home, then they come in to school and you expect them to get that same high from a text book!” and another agreed: “...if you know your customers, your clients, your kids, it’s what makes them click.”
- **Engaging and motivating the children:** some school leaders’ research and experience has led them to feel very strongly that game-based learning motivates and engages pupils and this was often cited as a reason for implementation; it would then provide a platform on which further learning could be built.
- **Preparing the children for future life:** school leaders want their children to be prepared for the world of work and to see them inspired towards a relevant future career, particularly in areas of Scotland where game design acts as a major employer; one secondary school also viewed game-based learning as a way to boost numbers in computing, vital for many games based careers.

- **Committing to new technology:** leaders also feel that game-based learning is just part of the great pool of new technologies that schools have a duty to adopt and help children understand.
- **Developing pedagogy:** active learning is very much on the agenda for schools, and senior leaders feel that game-based learning offers many opportunities.
- **Supporting transition:** three projects have come about as a means of facilitating transition, providing a non-threatening collaborative learning experience that will prepare pupils for the move to secondary. The projects start in the final term at primary level and continue at secondary level providing the children with a bridge between the two.

Reservations

School leaders expressed very few reservations about adopting game-based learning, though they often had an initial insecurity about what outside observers might think. One primary depute wondered at the outset, “Are they being successful learners, or is it a nice thing to do?” She added, “It should be both”, and many reiterate the need to ask, “Right, what are the children learning from this?” One leader took a more confident view, “We know the learning we want out of this, so therefore, we’re just going to be seeing what this tool [the game] does to help us.” Others had no reservations at all, but one early adopter said she would have stopped immediately if she had thought it wasn’t a learning experience.

Only one headteacher expressed scepticism about the power of technology to impact on learning and was noticeably reluctant about game-based learning: “I will have to see hard and fast evidence not just on attainment but on achievement and on pupils’ learning across the board...there’s a staff development issue as well...I would

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ask staff to justify this, say why this is really important, give me educationally sound reasons for doing it.”

Reservations were expressed about how parents might perceive the projects: “And the parents did voice concern because their view was, well they play all these things at home and sometimes they spend far too much time on them.”

Many of the leaders interviewed commented that observers might feel that game-based initiatives are a high-risk undertaking; they all had similar views on the matter: “Although it seems you’re taking risks you’re not really, they’re professional risks and bouncing them off other colleagues, you’re bouncing them off the children who bounce it off the parents, it all adds into the pot.”

One headteacher had reservations about the Nintendo DS as a platform for learning. Collaboration is a key objective for him and at first he could not see how this could be achieved with individual handheld games.

Many senior leaders were convinced of the value of game-based learning before they even began, so much so that more than one school committed to buying expensive equipment.

One primary headteacher was so convinced that it would be a great success that he said, “Hand on heart, my biggest concern was that if this [Little Big Planet] didn’t work, where do I go from here?” Thankfully he has been delighted with the outcomes.

One secondary headteacher with a track record of gaming projects in his school expressed a note of caution – the games must not become an excuse for baby-sitting; he also wonders if the bright and animated presentation of these games undermines other elements of the curriculum which have to be slower and less attractive.

Some senior leaders have expressed concerns about the need to keep learning current and fresh; this will have implications for the future of game-play, in terms of resources, repetition and keeping abreast of new developments. Several schools felt that game-based learning might only be relevant for perhaps five years but they would make use of it while it had an impact.

One headteacher observed that his natural inclination would be not to do game-based learning at all, but over the years he has had to learn to open his mind to new things; another commented that part of his role is to play devil’s advocate with staff.

What has helped schools to get started?

While the pathway to game-based learning varied for the schools participating in the study, there were commonalities amongst the headteachers in regards to the factors that supported, encouraged and enabled them to embark on game-based learning.

Risk-taking

The senior leaders in these schools often spoke about taking a calculated professional risk when they introduced game-based learning.

“You’ve got to start from the premise that it might not work. But then when you’ve gone a bit further and you think it is going to work, then you need to be prepared to commit to that and that means ... that you’re actually going to come up with money in the bank,” a secondary headteacher.

“The main feeling for me in the past year and a half since I came here has been to encourage creativity in staff and to let them run with ideas, find out the pros and cons with ideas and not be frightened to take professional risks with material and develop

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things in a freer more creative way to deepen the children's understanding," a primary headteacher.

Such risk-taking has to acknowledge the possibility of failure, but as one secondary leader said: "... even though not everything we take a chance on will work ... if you don't take chances, you won't get anywhere."

A pioneer teacher

Senior leaders appeared to be willing to place trust in an experienced, enthusiastic and well-informed member of staff who has approached them with a clearly expressed rationale, or in a teacher whom the headteacher has identified as being a suitable candidate to trial game-based learning. Leaders often see this as an opportunity for distributed leadership, ie a teacher taking on a significant development role that does not necessarily come with a position of status but which will bring about significant change. These key teachers are taking their school forward in a new area of learning and teaching. They provide vital help with information, planning, teaching, training, and resourcing, as well as reassurance and enthusiasm, supporting their colleagues to make a difference to the pupils; they play an important part in the embedding of game-based learning in their schools.

Internal ratification and support

Senior leaders gave clear signals of support to their leading teachers. As one secondary head put it, "...staff are not frightened to try things, they've got permission to proceed."

External ratification and support

Knowing that game-based learning sits comfortably with recommendations made by Curriculum for Excellence has brought reassurance, and one primary leader said, "It was something that

our authority was promoting as well, so you knew that you were supported." One secondary leader commented on the work of the LTS Consolarium saying, "You need evangelists so you don't feel you are working in a vacuum." In one case a visit from LTS was identified as being the key factor in bringing about a positive shift in staff attitudes.

Training and information

Local authority and LTS training and showcase events have helped some schools get started and many schools have held their own workshops. Teachers who attended events were able to experience the tools and gain insights on how they might be used; many cited that they see the motivational power behind the games as well as the low technology-skill threshold needed to implement them successfully in the classroom. Glow was often mentioned as a method of finding and sharing information about games. Schools also made use of the LTS Consolarium blog and LTS game-based learning web pages.

In addition to specific game-based training, several leaders identified the relevance of training to develop approaches to cooperative and active learning, as many of the learning experiences designed around a specific game are designed for team-based, collaborative problem-solving and production.

Informal hands-on experience

Opportunities to try out the games and talk with those who have used them are felt to be extremely helpful and many leaders encouraged teachers to take equipment home to familiarise themselves and work out how they will use it with their children.

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Resources

Joining pilot schemes meant resources coming in to the school on loan, which leaders have identified as a helpful opportunity to try out game-based learning without making a financial commitment before they are ready.

Timing and circumstance

Many leaders identified that the recent changes in the Scottish education system eg the introduction of Curriculum for Excellence, have made it easy to implement game-based learning in their schools, commenting that it fits well with current initiatives. In some secondary schools, previous efforts to make cross-departmental links have also helped to prepare the ground. In addition, the arrival of staff with relevant experience and specific training, including a specialist primary transition teacher appointed to a lower secondary team, has helped.

Successful projects and their benefits

The majority of school leaders viewed these projects as highly successful and are enthusiastic about their impact: "I've never been so convinced about the way forward with things. My absolute dream is to have a games console in every class permanently." Success with game-based learning is repeatedly linked by senior leaders to the pedagogical skill of the teacher involved. The game is often described as the hook or the stimulus and is never an end in itself.

Successful projects were identified by school leaders across all platforms and game packages. Successes using the Wii include: Little Big Planet (P4-S2), Endless Ocean (P4-6), Cooking Mama (P2-3), Mario Kart (P6-S1), Samba de Amigo (P6-7) and Band or Guitar Hero (P6-S1). Successes with the Nintendo DS include Nintendogs (P2), Professor Layton (P6-S3) and Gardening Mama (P1), and Brain Training (P7-S3). Successes with the PlayStation 3

include Little Big Planet (S5), FIFA World Cup (P7), Mario Kart (S1-S3) and EyePet (nursery). An Xbox success included Band Hero (P7-S1).

Interestingly, some games/projects at times were not seen as successful—such as implementations of Brain Training. However, based on feedback from teachers, this may be a result of the approach and methodology taken by the teacher in those specific projects.

Successful projects provide rich and realistic contexts for learning and embody the principles of Curriculum for Excellence. The principles of active learning and AifL (Assessment is for Learning) also sit comfortably and many projects offer realistic enterprise opportunities. Projects can also provide a relevant purpose for using Glow. Greatly increased motivation, engagement and enthusiasm are strongly identified as benefits, as well as social interaction, problem-solving, communication, cooperation, collaboration, planning, responsibility and increased confidence and self-esteem. Improvements in writing and numeracy skills are regularly mentioned. Opportunities arise for multisensory learning and provision can be made for a range of different learning styles. Pupils and teachers learn alongside each other and pupils often have opportunities to lead the learning, as well as becoming more independent learners themselves. Some secondary schools in particular have reported improved teacher-pupil relationships. Leaders have also noted some improvements in classroom practice, in both primary and secondary sectors.

Impact on the pupils

One primary headteacher reflected the views of many of the school leaders when he said, "As a motivational tool it has been unsurpassed....these kids are learning without realising."

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The stories of enthused, engaged and highly motivated pupils are manifold: pupils who had been reluctant to come school turning up at 8.30am to rehearse; pupils who rarely wrote more than a paragraph writing at length; pupils who never did their homework bringing in the fruits of their research unprompted; pupils who found group work impossible blending in to group tasks and even supporting others; pupils with behaviour problems settling down; summer term P7 pupils on task and inspired.

School leaders agreed that it would be difficult to attribute all of these things directly to the use of the game itself, but they strongly felt that there is a connection. Leaders also drew attention to the fact that children actually spend very little time using the game, quite disproportionate to the motivation it provides. There were accounts of hierarchies being flattened, as less academic and confident children increasingly demonstrated their game skills, confidence and self-esteem being built through natural peer-tutoring opportunities afforded by the game.

Where Wiis and PlayStations are being used, children are initially distracted by the game but this soon wears off as it becomes a familiar part of classroom life; children tended only to be drawn in when something exciting happened or when they see that a problem has arisen. These interventions were brief and seem to impact little on the wider work of the class.

Impact on the teachers

Repeatedly, school leaders say their teachers have been enthused just like the pupils. One teacher took a game console home for the first time: "She came back in buzzing, just full of ideas." Teachers have eagerly developed rich projects around these games and have felt rewarded as the projects have progressed. One headteacher felt the additional creativity of these projects gives teachers extra motivation.

For many leaders, the professional discussion that arises from these projects is vital; teachers are thinking about what they are offering and are talking about the impact; in secondary schools this is making important connections across departments. In more than one instance, leaders have seen an improvement in teachers' classroom practice.

Where a teacher has not been so keen to be involved, school leaders note that an element of peer and pupil pressure can add impetus to the development of a project, particularly in an open plan school. With regard to any teacher adopting new practices a secondary head commented: "I think you do have to recognise that not everybody will be at the same place at the same time."

Changes to practice in learning and teaching

In the majority of schools visited, any changes in learning and teaching have been attributed to the introduction of Curriculum for Excellence and the development of active and interdisciplinary learning rather than game-based learning per se, although many have commented how well game-based learning sits within the new frameworks and approaches: "This has come along at the right time...our staff have a lot of freedom to be innovative and creative – [Curriculum for Excellence] has helped to open up the topics and give more of a rich interdisciplinary element."

Teacher role: Developing the role of the teacher is vital to the success of game-based learning, as one primary headteacher observed: "You can put children on to use games and play games but unless the teacher has an understanding of how to develop the thinking and learning, it won't have any benefits."

School leaders have been impressed by their teachers' willingness to learn from the pupils: "Staff not being scared to say 'Oh, show me

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how to do that.” They have noted that although this has taken some teachers out of their comfort zone, they have been willing to take that chance and have reflected positively on the experience. One secondary head said of his staff: “We now have more staff who are quite confident at not being competent when it begins ... because they know that there’ll be a kid there that will help them.”

Game-based learning has given teachers the opportunity to let the children take a lead with curriculum planning and activities and teachers have often found themselves in more of a supporting role. A primary headteacher reflected “Historically teachers have been the planners, facilitators, have done everything...some teachers’ still want security of certainty, but are beginning to be able to respond in a more flexible way.” This change was echoed by a secondary head: “It’s more active learning for the youngsters so the teachers need to teach in a different way. It’s less didactic.”

Classroom management: To introduce a Wii and incorporate it into everyday routines, or to manage with only ten DSs in a class of thirty secondary pupils, requires specific thought to be given to organisation and practice: “You’re talking about the kids having maybe 10, 15 minutes a week on the actual game...They’re strictly timetabled, very little actual game-playing time.”

Curriculum organisation and development

Senior leaders are keen to clarify the role of the game, as one primary headteacher explained: “It’s a tool, it’s very much a tool, it’s not an end product, it’s a tool to engage children in learning.” The game is the hook or the stimulus, both for the learner and, in many cases particularly at primary level, for developing a rich and wide learning context. In some secondary classes the game provides a particular focus in one subject (eg maths or French) but it is still valued as a hook or a stimulus for learning.

Schools are taking great care to clearly identify the learning outcomes in their projects; in addition they are identifying gaps in other projects to see if game-based learning topics might provide the context for filling those gaps; they are also looking at existing topics to see if a gaming element might be added. Schools are beginning to consider a progression in game-based learning and in some cases are linking it to computer game design.

In order to accommodate the children’s ideas, schools are being flexible in their approach to planning: “Part of the planning also has been with the children so that it’s responsive and it does reflect their views and they’re part of the process” which can lead to unexpected results: “The places the children took the project was beyond what even I’d imagined.”

Secondary school leaders feel that they can learn from their primary colleagues; one observed that games are providing impetus for ensuring relevance and connectedness in the secondary curriculum and another stated that there’s “a lot of game-based learning in primary schools – we need to alter our delivery to match that.” The deployment of transition teachers and the development of projects with a transition focus are felt to be very valuable here.

Resourcing game-based learning

Some schools are both buying and borrowing resources although one headteacher was so convinced about game-based learning that she bought ten Wiis immediately. Others are more cautious. Borrowing, either from LTS or the local authority, has helped many schools get started. These loans are often in conjunction with the running of a pilot project, although in some cases involvement in a pilot scheme has brought funding towards equipment purchase.

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Borrowing raises issues of sustainability and predictable timetabling for future projects, although many schools then go on to purchase similar equipment for themselves, appreciating the opportunity of the trial run. Some headteachers have expressed a wish that there could be bigger banks of equipment to borrow, recognising the increased interest in this area of learning. Some local authorities lend equipment to schools on the basis of submitted bids.

Schools are funding the purchase of equipment in many ways, often through the Determined to Succeed budget which supports the development of enterprise education, but also via the school fund, parent councils and even children's own enterprise projects. Concerns have been raised about procurement procedures, which can make it impossible for schools to get the best deal. In some schools, equipment has been donated, teachers are bringing in their own consoles and in one case children have been asked to bring in consoles for a finale event.

The main expense is hardware and schools are thinking carefully about which platforms and how they will be used. The games themselves are much cheaper and many packages have the potential to be used over more than one year group, offering opportunities for progression or flexible use. Some staff are being asked to bid for purchases and also they find that thought has to be given to running and refresh costs.

Senior leaders want to be kept up to date about games and equipment, and appreciate the efforts of LTS and local authorities to inform schools.

Schools are also funding associated technology, laptops and in particular the application Crazy Talk – which allows you to easily generate a talking character from a static image, using the pupil's own images and text – to develop the context for game-based learning.

Assessing game-based learning

Although school leaders feel that game-based learning projects as a whole sit well with the principles of Curriculum for Excellence the requirements for assessment are still being formulated, resulting in a degree of uncertainty as to what the future might hold. There is little concern at primary and lower secondary levels, and one primary headteacher spoke for many when she firmly stated: "...the assessment is never about the games, the assessment is about the focused curriculum areas that we are looking at...the teacher looks critically at what she wants the children to be able to know or do through it, and she finds a creative way to assess that, so I'm more than comfortable about where the assessment is."

In the small number of instances where Brain Training is being used, schools feel they will need to identify impact on speed and accuracy and had some concerns that they had not done this.

One secondary headteacher expressed some concerns about assessment: "Is the exam system going to measure confidence, articulacy, self-evaluation, knowing your place in the world, and feeling that you've got self worth?...A lot of the principles of CfE [Curriculum for Excellence] are aimed at [entrepreneurship] but the concern is, will anyone ever value it when we've done it?" Another secondary colleague also raised concerns: "Secondaries have one eye on attainment, and if games aren't offering us anything on that they won't be any good."

One secondary school uses cognitive ability testing, which gives them knowledge about pupils' learning styles and they are trying to link this in to their work on games.

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The wider school's response

In primary schools the response of the wider school has generally been positive, with leaders talking of like-minded staff that have asked to join in; as one primary leader observed: "The more you do it with people, the more other people want to ... get involved." Where there has been negativity, another leader reflected: "Different teachers needed different levels of support and that's normal in anything... rather than worrying about negative responses, allowing people to do it in their own way...taking them along in whatever capacity [they] could manage to follow." Occasionally some staff have expressed a view that some children should just concentrate on reading and writing, and concerns have been voiced about the cost of equipment.

At secondary level the interdisciplinary aspect of some projects has daunted some staff but staff room exchanges, peer observations, team teaching and teacher learning communities have all helped allay uncertainty. Leaders are reluctant to impose initiatives: "Things that are led by enthusiasts and people who are keen are much more likely to be successful... I think you get more out of encouraging and convincing people than you do out of saying well that's it."

Sharing practice

Schools are sharing in many ways within their own schools and clusters, via software demonstrations, lesson observations and staff-led training sessions. They are sharing with other schools via Glow and by welcoming visiting teachers. Several schools have spoken at local authority good practice events and national events such as the Scottish Learning Festival and the Measuring the Impact of ICT in Children's Education (MIICE) and the Game-Based Learning and Handheld Learning conferences. Practice has also been shared

with parents via blogs, letters sent home, parents' evenings, and invited into the classroom to participate.

Parents and game-based learning

School leaders were generally concerned about parental responses at the outset of these projects and many send letters home to try and communicate to parents the benefits of game-based learning. The response from parents was often positive and many have come along to open events to share in their child's learning. One parent council was so impressed that they gave £2000 to the school for further equipment. Parents have also had access to projects via Glow and in some cases have come in to school to share relevant expertise. Parents have commented that their children have expressed significant interest in projects at home and some families have bought the games for home use.

Support received

Schools have valued the support they have had from the LTS Consolarium team in terms of resources, advice, information and presentations and the knowledge that help is only a phone call or email away. Heads have also identified the importance of the affirmation that working with LTS brings and the visits the LTS Consolarium team has made to see projects in action. The LTS game-based learning site and the LTS Consolarium blog are also greatly valued. Many schools have collaborated on pilot projects, which have brought all of the above benefits.

Local authority teams have been greatly appreciated too, for instigating projects and for the practical and personal support provided.

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Further support

Schools that have worked to a significant degree independently of LTS would welcome visits to share what they are doing and access external expertise. It is generally felt that LTS should continue showcasing effective practice to give people confidence. Building communities of practice is seen as a vital part of the LTS role and the growing role of Glow is felt to be central to this. Assessment exemplars for game-based learning would be a very helpful addition to the national bank and faster feedback from projects about the impact of game-based learning was identified by one secondary school. Another secondary school feels LTS should find more examples of games for secondary pupils.

The future

School leaders are adopting and embedding game-based learning, as one primary head observed: "...we're aware now of the learning potential that is there, so we'll use it." Schools are developing new projects and making sure existing ones are rigorous in terms of experiences and outcomes and continuing to be relevant and fresh. In some cases schools are planning to assess impact more closely, notably with Brain Training but also writing. They are looking at the timing and distribution of projects across the school and thinking about breadth and progression as well as the issues of composite classes and transition. Some schools plan to give more information to parents at the start and change how and when they involve parents in open events to ensure a good turn-out. Leaders are working to stay informed and keep abreast of developments and in some cases schools are setting up development groups — staff are being sent on training courses or working alongside more experienced teachers. Leaders are asking staff and children to reflect and feed back, and are consulting them about next steps. Leaders are also looking at resourcing.

Summary

Overall, school leaders responded very positively in regards to the potential and impact observed thus far by game-based learning initiatives in their respective schools. Outcomes observed in students included the development of confidence and self-esteem, and increased motivation, enthusiasm and peer-tutoring. The observed impact on teachers included increased enthusiasm, change in teacher role and pedagogy towards a more constructivist, student-centred approach. Assessment at the primary level was often integrated into the projects built around the game theme; however, some secondary headteachers expressed concern around the need for better assessments in this approach to teaching and learning. Leadership emphasized the need for risk-taking, supporting pioneer teachers, internal and external support and training for the game-based learning initiatives to be successful. Likewise, professional collaboration and sharing as well as parent communication tended to be key areas of focus.

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The teachers interviewed range from Nursery to S5, and from the newly initiated to those who have been using console games in teaching and learning for three years. The great majority are very enthusiastic about the impact of game-based learning on their pupils and on their practice, and whilst they caution against overuse, they feel it currently has a valid place within Curriculum for Excellence.

What do game-based learning projects look like?

Schools considered the hardware, software and their local circumstances when deciding to use console games and projects were tailored accordingly. Consoles used include the Nintendo Wii, Nintendo DS, Sony PlayStation and the Xbox. The games for these are commercial packages, not specifically designed for school use, but teachers were choosing games that they feel have learning potential. The desired learning outcomes for the project are identified and various learning experiences are developed around these, with the game fitting in where appropriate to a greater or lesser degree. Teachers identify collaboration, communication, teamwork, motivation or engagement as reasons for incorporating games into their practice, as well as any curriculum specific objectives. A major factor in the success of these projects is the care taken over classroom management and the organisation of pupils, resources and tasks.

Broadly there are two models for the use of games in the schools we visited, the context based approach and the focused learning outcome approach; teachers may use both over the course of a year, depending on their needs and circumstances. Whichever approach is used, teachers are reporting gains in terms of pupil engagement and motivation as well as specific curricular benefits, and often feel these gains are sustained over time.

The 'learning context' approach

Teachers talk of the game as a 'hook' or a 'stimulus' for a rich, often interdisciplinary, often authentic, programme of study or 'learning context,' which is built around the game. The game itself is not necessarily the main focus – actual game-play may be as little as ten or 15 minutes per pupil per week and will often diminish as the project unfolds. This is the most common approach and is used in both primary and secondary settings. It sits well with the requirements for Curriculum for Excellence and offers opportunities for active, collaborative and pupil-led learning. Primary schools tend to be familiar with this way of working, and examples can be seen in the case studies, but there are examples in the secondary sector too, both as single subject and as interdisciplinary initiatives.

Single subject learning contexts in secondary classes

Hotel Dusk or Phoenix Wright on individual DSs in S2 English classes provides a starting point for a rich mix of experiences - via Crazy Talk, Audacity, film noir, You Tube and old radio broadcasts - to deepen understandings of genre and characterisation, resulting in some impressive reports, scripts, game walkthroughs and audio performances, as well as much discussion and collaboration en route.

Just Dance or Mario Kart on the Wii or PlayStation gives S1 pupils inspiration for their work in computing (designing games of their own and understanding the role of programming in a real life context) or graphic design (where it can provide a motivating and engaging theme for a design task).

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Little Big Planet on the PlayStation offers S5 Intermediate 2 information systems pupils a challenging and rewarding opportunity to learn about real-life games design as they work in project teams (including project manager, designer and programmer) to create games for their P1 clients in a neighbouring school.

Interdisciplinary projects in secondary settings sometimes involve changes to timetabling and pupil groups, but this is by no means necessary and some game-based learning projects have gone ahead without any disruption as the result of careful coordination between departments.

Professor Layton and the Curious Village on the DS has been used to make links between the maths, English, geography, French and music departments to help connect learning across a range of activities and skills in S1. With careful advance planning and some small shifts in the timing of curriculum content, what started as an idea for improving problem solving in maths has become a coherent interdisciplinary project, which takes place across the usual lessons in these subjects for all pupils in one house group over a period of seven weeks.

Primary and secondary schools have also come together to create learning contexts around games to support transition, notably using Guitar or Band Hero. Teachers from both sectors collaborate during the summer term, with the project culminating in a special two day event themed around the game to introduce students to their new phase of schooling. In some cases the learning then continues into S1, with departments working individually but on related tasks stemming from the game.

The focused outcome approach

The game is used to develop a specific aspect of learning, eg using My French Coach on the Wii to develop vocabulary, or practising mental calculation skills using Brain Training on the DS in maths. Typically it is used as a short, isolated activity within a main lesson, providing a focused start or an incentive to get other tasks completed. Pupils may complete an activity on an individual DS or work in groups using a Wii or PlayStation, or work as a class via an interactive board. As before, the game-play may only last for ten to 15 minutes.

Teachers' initial reservations

Teachers expressed a variety of initial reservations about trying game-based learning but the majority found that these quickly disappeared once the project began. Concerns included:

- Feelings of panic about the game and the technology;
- Worries about the teacher-role and pupil responses;
- Queries about the relevance of the learning and the role of the game;
- Questions about classroom organisation and implementation;
- Uneasiness about the number of new initiatives in an already busy curriculum;
- Fears about parental and public perceptions.

The more informed or experienced teachers are in terms of game-based learning, the fewer reservations they express.

Teacher perspectives on student impact

Regardless of approach, the words 'motivation,' 'enthusiasm,' 'engagement' and 'fun' came up time and again in response to questions about the impact of game-based learning on pupils.

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“The kids just adored it... the motivation level was really, really high”

“I do think you get youngsters engaged... and although they're only using the game for a few minutes, it's enough to motivate and capture their interest.”

“The children love it. I think that using the console just gets them so excited about their topic.”

“Their motivation, you know, they were totally engaged. They were on task, they were very interested in it. They spoke about it a lot.... They were just highly motivated.”

And it would seem that these elements of motivation, engagement and fun are a crucial part of the success of the games projects – the children get hooked into wider learning opportunities because they find the game experience itself so enjoyable, with rewards for pupils and teachers alike.

“When you see the motivation and engagement for the pupils, I mean that's your core goal, I think, as a teacher, and if you've got that, the learning just comes on so much more,” P7 teacher with wide experience of game-based learning.

“...they would ask for it and ultimately for me they're asking to do mental maths. Now they would never normally do that,” Secondary maths teacher, of Brain Training.

“It's been the enthusiasm from the children... just seeing how much they want to do it.they're just so enthusiastic and seeing them really want to learn and want to develop their skills,” P7 teacher.

Teachers identify many benefits relating to teamwork and skills for life, including problem-solving, communication, collaboration and negotiation, which were observed in various ways by teachers:

“...they were working together, which was so great, they were discussing things and pointing out things and noticing things and supporting each other's decisions and things. So I'd say like role-wise, they became a bit more appreciative of other people's ideas...they were actually coming up and telling me and they were definitely working well together effectively, sharing things, making decisions, a lot of critical thinking was going on as well,” P4 teacher.

“And it was the children who actually organised it themselves... they were dividing their tasks up into you find out about this and we'll do that,” P7 teacher.

“I saw the 2s really using their skills and their language abilities of persuasion and just the way that they were mature enough to negotiate. On the whole, there was the odd one or two that didn't get on but, on the whole the 2s were very good organisers and they made sure the task actually got done,” P1/P2 teacher.

“It sort of developed that resilience in the children as well and the problem solving and trial and error, 'Give it a go, oh it didn't work, let's try something else, how could we change it to improve it?' ” P4 teacher.

The team work and opportunities to support their peers often bring unexpected children to the fore, children who are not usually seen as the leaders or achievers, children who are normally shy or children who previously have found it difficult to work in groups.

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These new roles and unexpected successes add to the confidence of many children, for example when they can demonstrate their technical ability and game-play skills, as one secondary maths teacher reflected: “The less able kids really grasped on to it because it was a medium that they could understand and they were willing to try and they were quite often helping people that I would never have expected, slight turn of events there and it was nice to see.”

A principal teacher gave another indicator of growing pupil confidence: “He doesn’t just want to do the tasks that I’m setting him, he’s then gone off and become an independent learner.”

Children are teaching each other, both within the class and as buddies and mentors coming from other classes and schools:

“My P4 learned from a 4/5. And then my 3/4 then taught the Primary 6s.”

Many teachers speak of the impact on pupils’ writing – their willingness to write, the length and the quality of their writing, particularly for boys. One chartered teacher commented, “It really transformed their writing.” The number of Level D passes (Level 4 in England, Wales and Northern Ireland) at P6 has risen markedly in one school, attributable at least in part to a contextualised approach to games. They suggest that it is the game, combined with the rich learning context, which provides the stimulus and sense of purpose that might be lacking in some other writing tasks. A P7 teacher noted: “And their vocabulary has come on because it’s something that they’re interested in and they can relate to and they’re more enthusiastic about writing about it. And because it is part of their topic, they’re thinking about it all the time.”

Children also seem to read more willingly in the context of the game, becoming motivated to follow instructions on screen or work out puzzles in order to progress. A secondary transition teacher remarked: “.... the lower ability levels, they didn’t even question the reading, because they knew it was to do with the game and they had

to read the instructions about the puzzles.” A secondary English teacher regularly found her S2 pupils reading silently from the game and making notes, quite unbidden, to capture information they would need for future tasks. Reading for information beyond the game also seems to increase, with children even creating homework tasks for themselves and bringing in their research to share. A P5 teacher identified a boy: “He came in the other week, ‘I’ve been researching the different levels of the ocean. We’ve not done that in class, can I tell the class about it?’.” A P6/P7 teacher was amazed at the children’s enthusiasm: “The things that came in from home that they did just themselves at home, it’s was just fabulous, we had a whole wall at one point of work that they’d done at home.”

Benefits have also been strongly identified for children with specific learning difficulties, including dyslexia: “I’ve got two boys in particular who are both dyslexic and really quite severe learning difficulties, and they can get to be a part of it and I think they feel because they’re working collaboratively, they feel more a part of the class than they do in general.” Teachers of children with autism have seen an impact, both in a mainstream class: “He was more motivated and engaged in his learning too, especially again, it’s the writing side of it that I do find improves a great deal as well”, and in a special unit: “Four kids who don’t always or often do things together one day were on there giving it big laldy, big licks*.... And asking ‘are we doing that again next Friday, are we doing it again?’.” [*laldy: Scots vernacular - to give something laldy means to do something with gusto; licks, music vernacular, meaning a guitar playing sequence.]

The kinaesthetic benefit of the games has also been recognised; many games offer practice with hand-eye coordination and for some children just the opportunity to get up and move around that the game brings has proved beneficial, allowing them to re-focus and the settle again to their original task with better concentration.

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The authenticity of the context provided by the game is often commented upon as having a very positive impact on the pupils. They are taking on 'real' identities as rock stars or racing drivers, they are looking after 'real' pets with 'real' needs and managing 'real' budgets in order to make a profit or purchases, so the learning takes place in a context that they have committed to in role and can make meaning of through their adopted personae or pets. As a result, the writing is more enjoyable, the maths makes more sense, and the children feel they have 'real' reasons for doing these tasks.

Boys and girls have enjoyed the projects in equal measure, despite some initial reservations on the part of their teachers about gender-biased content that favoured boys (FIFA World Cup, Mario Kart). A P7 teacher was delighted to see two highly sceptical girls becoming skilled and enthusiastic players, who ultimately engaged well with the wider football project and the related international study. But another P7 teacher cautioned, "I'm not so worried about the girls now, but I'm very aware when we're doing an activity that it must be wide enough to include them." By contrast, games such as Little Big Planet, Endless Ocean or Gardening Mama might have a more immediate appeal to girls; teachers should give careful thought to the software choices they make over time and to the nature of associated activities, to ensure that both girls and boys can relate to them and gender stereotypes are not reinforced.

Concerns about the game distracting learners have been largely unfounded. The initial excitement soon settles down, children get used to their new routines and they generally ignore the game-play area unless something particularly exciting happens (like discovering a whale or the drama of 'race day'). Where necessary, teachers have rearranged furniture, rotated seating plans or set up a screened area in a corner of the class to minimise distraction.

Impact on teachers and teaching practices

Enjoyment and motivation

Participating teachers have indicated they valued participating in the projects as much as their pupils, due in no small part to the enjoyment and motivation they see in the children; this came through strongly when we asked teachers what had pleased them most:

"The children, seeing how excited they are about their topics, their parents talking about it, how keen they are to learn about their culture," P7 teacher.

"I think just the motivation ... the pupils were so eager to come in every day, they would come in talking about it and things and just the enjoyment they got from it," P2 teacher about Cooking Mama on Wii.

And the authenticity factor is also valued by the teachers:

"I absolutely love it. It's fantastic...it's the enthusiasm of the kids. ... Well I mean it is the real life situations....Give me a context that you could teach children about budgets that's no' dead boring.it's real life learning, but it's in a context and to be honest they don't actually realise that they're learning about it." P7 teacher enthusing about projects based on Guitar Hero and Samba de Amigo.

Teacher role

Teachers are finding that their role is changing in various ways. A secondary teacher has been enjoying the chance to interact more with groups: "It meant I was up at the board a lot less, and I was doing a lot less talking to whole group, I was more focused on smaller groups and seeing how they were getting on and that was quite nice as well because I don't really get to do a lot of small group

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work.” This has now influenced her wider practice. A P1 teacher also noted: “It has changed me as a teacher because I see myself far more as a facilitator.”

Teachers used game-based learning to identify opportunities to give pupils responsibility and to involve them in decision-making. “I think it’s getting over that hurdle to begin with, to realise oh, hold on, the children can help and I’m not just going to be the only one that knows how to do it and has to know how to do it, it’s taking onboard the children and letting them be kind of leaders of their learning as well,” P6/P7 teacher and depute. It is of interest to note that a number of relatively new teachers have become more confident about letting go of their central role in lessons.

The change in role it isn’t always comfortable but it is felt to be worthwhile, as a secondary teacher reflected: “I just took a back seat and so it [the learning] was completely active...I mean I had a totally hands off role...It was quite scary...but I soon realised that they were managing fine. As soon as they understood what their goals were, they were off...it’s definitely changed the way I’m going to be teaching.”

Student roles have been impacted as well, as pupils have willingly unpacked and connected equipment and have confidently dealt with technical problems or found fixes for games. Many agree this learner role takes them out of their comfort zone, but they are willing to go there because they can see benefits for all. Indeed some would rather learn from the children than another adult: “the children might even be able to show me better because I think I might feel awkward that if an adult’s telling me and I don’t pick it up quickly.” Some teachers actively want to model themselves as lifelong learners.

Classroom management

Teachers are enjoying being able to work with and assess specific groups but agree that they have to be highly organised in order to keep the game running and move groups on through their tasks. P2 teacher commented, “I really had to think very clearly how I was going to organise the class...I’m a bit regimental at times. I don’t like a free for all.” Lessons observed were indeed highly structured and planned. Teachers have identified the organisation as one of the hardest aspects but the reward is that the children know what they are doing and the teachers are freer to interact and observe.

Teacher skills

Using console games has led to teachers becoming more ICT orientated; they are using a lot of technology packages such as Crazy Talk and Audacity, often for the first time, as well as Glow and blogging with the children. They feel the games themselves are making them more aware of “things that are out there.”

As a result of learning new skills and developing in new areas by participating in game-based learning, some teachers indicated that the experience had helped them to become more reflective and creative in their practice.

For the great majority of teachers the overall experience has been positive. Very few teachers felt any reluctance to take part and in this study only one seemed to have really struggled to enjoy it, though even then her children’s enjoyment was recognised. One teacher explained, “the children have thoroughly enjoyed it and more so because of the Nintendo Wii,” citing that she felt rather swept along by a powerful new initiative that she doesn’t understand. Several weeks in to the project she said: “I’m a beginner, I’m just being led... I just was asked just to join in. ...I didn’t actually ask many questions, what’s the outcome, because it’s just to me ... to

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me it's just another topic that we do." She had never set up the game or even played it and was anxious about technology.

She was struggling to cover the ground that had been mapped out for her and did not have a game console in her class so was having to send pupils to another teacher's room, which was proving very difficult to organise. She also felt she had had to give up many aspects of her classroom life that she held dear, such as visits to the library, and could not understand why and was worried about fitting in the things she'd missed.

Where teachers are being brought on board by more experienced or enthusiastic practitioners, it is vital that they are given information, support and time to become familiar with the game, equipment and purposes behind them, so that they do not feel too stressed and vulnerable, so children and teacher both get the most out of the project. It should be made clear that there is only one instance in our study of a teacher feeling out of her depth in this way, but the implications should be noted, so that as game-based learning spreads, staff are given the support they need.

Curriculum organisation and development

Curriculum for Excellence and the current growth in active, personalised and interdisciplinary learning are felt by teachers to have more to do with any changes in curriculum organisation and development than the specific requirements of game-based learning. Indeed, teachers feel that working with games offers a very natural way to implement these initiatives and, for infant teachers in particular, the methods feel very familiar. The fact that these are commercial packages and come with no teacher guide or resources does not seem to cause any difficulty: teachers find it very easy to incorporate them into their planning and view them as a great stimulus for ideas.

Many of the teachers realised that game-based learning projects can bring a context that is meaningful to the children and this helps pupils to become more involved and make relevant suggestions. Real world links are being sought in many instances – interviewing a genuine marine biologist, using transport web sites to make bookings for a band tour, applying for posts within teams by presenting a CV and job application to a 'company director'. Teachers are also saying that the energy that comes from using games has changed their whole way of thinking about the curriculum as they look for ways to "totally engage them at this high buzzing level" beyond the games projects.

Whilst there is great enthusiasm for incorporating games into the curriculum, teachers caution against over-use, in case the medium becomes stale, and because a game is not always the best vehicle for the learning to be covered. They identify the danger of choosing games for their own sake rather than for the genuine value they can add. They also warn against trying to make everything in the curriculum link to the game, and stress that links should be valid and, where valid links are made, these should be made explicit to the children so they understand how their learning connects.

Assessing game-based learning

In the context-based projects, teachers have very few concerns about assessment; the experiences are planned to clear learning outcomes which can be readily assessed through normal classroom practices of observation, discussion and evaluation of finished or emerging pieces of work; the game itself is not the focus for assessment, although the collaborative behaviour or discussion around the game-play might be. In the one project where public examinations are involved, the teacher has been able to tailor the context to meet the Intermediate 2 examination needs, and in some respects feels the project may have given his students an advantage:

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“They were all updating their CVs, because they had sort of proper project management experience or proper development cycle experience....One of the questions that comes up in the exam, it’s about the personnel and it’s always one that’s done badly, so that was fairly obvious that they understood exactly what their own role was. So they could explain it in an exam.”

Some teachers expressed a lesser degree of comfort where games are being used to develop very specific focused outcomes such as mental arithmetic (as targeted by the game Dr Kawashima’s Brain Training). Although the game can track performance and progress, the LTS Consolarium recommends an assessment methodology for this game that leverages an alternative assessment mechanism created by the teacher. During this review, some teachers commented that they did not find it easy to measure impact and progress with this game, indicating that there may be a greater need to ensure that the appropriate methodologies with certain games are made clearer to teachers who aim to use them.

Parents and game-based learning

How parents will perceive the advent of games consoles in classrooms is often mentioned by teachers as a noteworthy reservation at the outset of these projects and explanatory letters are often sent out. But the overwhelming long-term view is that once parents can see what their children are doing with the games – via Glow or open classroom events or even the lively response of their child to homework tasks – fears on both sides quickly recede.

What has helped teachers to get started?

Most teachers in this study have had little or no formal training but the following circumstances and approaches have proved extremely helpful in getting them started with game-based learning:

- **The children:** “Wouldn’t have worked without the kids. They totally bought into it and they were the biggest help,” secondary teacher. “The best training that I had actually came from the children,” chartered teacher, primary.
- **Knowing the game:** The great majority of teachers have found it helpful to familiarise themselves with both the hardware and the software in their own time at home before sharing it with the children.
- **Experimentation:** “Just try it, see where it takes you...Our kids don’t have the fear, they go in with an open mind,” P3/P4 teacher. “It’s learning with them, being prepared to learn with them. When it comes to games consoles you know they do know their stuff,” secondary English teacher.
- **A supportive headteacher:** “Having someone like [HT] who gives you the freedom to do that, and doesn’t impose strict boundaries... he’s given me the freedom to know my children, to know the learning that would benefit them, and he’s given me an amazing stimulus for it.” P3/P4 teacher
- **A supportive colleague:** “It was really inspiring working with [V], obviously she’d done it before... it was my first time, but I really felt I learnt so much from her.” (P7 teacher) Teachers have also appreciated opportunities to observe colleagues’ lessons.
- **Support from LTS Consolarium and local authority staff:** The direct and indirect support from skilled and knowledgeable colleagues at local and national level has been greatly valued and has been a particular influence on the lead teachers: “I think the biggest thing was just it was quite inspirational and quite ... just made you come away thinking ‘I just have to do that, I just want to get involved’.” P6/P7 teacher and depute, speaking of an LTS day

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on game-based learning. She continued: "I think, as a council, it's going really well just in the support that's available and the resources as well that are available as well, are really good." Visits from LTS staff have proved motivating and helped to clarify project objectives, and teachers appreciate the ease with which they can make contact by e-mail or phone. Teachers have found borrowing resources extremely helpful, from both LTS and local authority teams.

– **Glow and other remote resources and sources of information:**

The LTS Consolarium web site and relevant Glow groups are used by many teachers to inform their practice, via documents and dialogue. Teachers are also downloading documents and exemplars, from LTS, Glow and Teachers' TV, and adapting to their needs: "You can just cherry pick what you want." However several teachers in the study do not yet have easy access to Glow because their local authorities are still establishing the technology and training programmes in some schools are yet to be completed.

– **Networking:** Teachers are talking to each other across Scotland, via Glow and their own blogs, including several teachers within this study who have never actually met: "So the professional dialogue, I think, is probably the biggest support that we could have really, just so that we can talk to each other in school and then Glow then allows us to link with other schools as well around Scotland," P4 teacher.

– **Curriculum for Excellence:** The implementation of the new curriculum was identified by many teachers as a great opportunity to try something new.

Sharing practice and collaborating

From the positive impact on teachers' practices, many have welcomed opportunities to share practice and disseminate and develop ideas — from collaborative planning to hosting visiting teachers, speaking at teachers' meetings or collaborating with another school (by direct or virtual means). Several notable strategies and approaches shared by teachers demonstrate how they are successfully implementing and growing their game-based learning:

– **Collaborative pre-planning:** Discussing aims and objectives at the outset is an important way of reducing the stress of the unknown and ensuring that principles are understood and embedded, such as how the game relates to the rest of the learning, or effective classroom management practices which will support both teacher and learners. Key teachers are playing an important role in this respect, and are greatly valued by their colleagues.

– **Teacher innovators and champions:** Advanced, forward-thinking and well networked teachers work in and amongst schools to spread the knowledge and good practice around game-based learning.

– **Peer classroom observations:** Visiting a classroom during a project allows teachers new to game-based learning to observe pupils and colleagues at work and helps to make sense of what is being advocated. Teachers are willingly opening their doors to allow this to happen, and both observer and observed feel that they benefit from the experience.

– **Informal sharing:** Whether via staffroom chat or corridor encounters, chatter on game-based learning raises awareness and leads to new projects. Teachers are sharing their experiences

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more formally at school, local and national levels, through presentations and game workshops, which can also involve the children.

- **Virtual Learning Environments:** Teachers and children are both using Glow to share their work, for example children from one school leading a Glow Meet to showcase their Endless Ocean work to children at another, in order to help them get started on an Endless Ocean project of their own.
- **Local authority support:** Working groups and pilot projects hosted by the local authority aid in bringing teachers together to share, promote and develop practice, and often result in case studies which can be shared.
- **School partnerships:** Schools are collaborating to develop projects, such as a powerful anti-sectarian initiative explored through Band Hero and Teresa Breslin’s novel Divided City, developed between a non-denominational and a denominational school in a village where sectarianism causes rifts.

The future

For many of the teachers, once they had completed one game-based learning project, they sought opportunities to participate in other game-based learning projects and to find other ways to incorporate games into their curriculum.

Teachers are reflecting on current projects with their children and looking for any changes or developments that could be made, taking care to aim for a balance of experiences over a year, and aware of

the flexibility that has to be accommodated when pupils are contributing to the planning. In many cases teachers are beginning to plan for continuity and progression in game-based learning across the school and even across school boundaries, where transition projects are involved.

Where there are teachers looking for new games to include, those in the early stages often feel there are not enough suitable games for infants, and in secondary schools some subject teachers, for example in chemistry, have been unable to find a game to use despite being extremely keen to add game-based learning to their repertoire. Teachers of children with additional support needs have also indicated that there is little choice of games for children at the lowest levels of achievement, though they continue to look.

Where teachers have used a focused outcome approach, they are planning to develop tests that will allow them to gain additional information about the pupils. Additionally, many teachers are planning ways to share practice within the school, including working with staff to try small projects, providing materials, organising training sessions and using pupils as trainers and supporters.

As more teachers become involved, they are having to make decisions about timing and resourcing projects. In some cases they are putting together bids for equipment, from school budgets or from local authority loan schemes, and in some schools teachers are bringing in their own consoles to help ease the demand. Some schools are finding it difficult to plan for the future because they have borrowed equipment and do not know when it might be available again, particularly as awareness is raised and interest grows.

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Further support

Some teachers identified a range of support strategies that would be useful in taking game-based learning forward:

- More exemplars and materials on the LTS Consolarium web site and on Glow, including case studies, assessment materials, samples of children’s work, videos of practice, and ideas for classroom organisation and management;
- More teachers actually sharing their work through Glow, so that people can see more of what has been done;
- Opportunities to see at first hand what other schools are doing;
- Opportunities for children to play games against each other remotely;
- More information about games for particular age groups, abilities and subjects, and how they could be used;
- Commercial game producers to spot the educational potential of the games they produce;
- Access to resources, via funding or loan systems, or cluster sharing schemes;
- Time to get to know a game and prepare materials;
- Time for staff to come together to plan;
- External validation — someone external coming in to say, “You’re doing a good job!”

Summary

It appears that game-based learning can have a powerful impact on both pupils and teachers. Some teachers have come to it not really knowing what they were trying, and very few are game-players themselves but, having tried it, teachers view it as a highly effective tool for learning and want to add it to their repertoire. A notion echoed by many teachers is that “I think you’ve got to [play the game] before you realise how important it is to the learning of the kids,” P5 teacher.

They are prepared to overcome reservations about new technology and parental perceptions, and alter their classroom practices and teacherly-roles to take this new medium on board, recognising a clear place for it within Curriculum for Excellence. Many make use of the support systems and conduits for information that are coordinated by LTS and the local authority teams and are very appreciative of the often personal, individual contact they have with the LTS Consolarium. Many are also going on to share their practice with others, keen for more teachers to join in and bring a rich experience to their pupils.

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General impressions

The overall student perspective on console game-based learning in the classroom was a positive one. Many students reported that the overall project associated with the game was 'very fun' - often noting that it was a more fun way to learn maths, writing, or whichever associated content/skill. While the enjoyment described by students referenced the game play, it was the associated curricular work and learning that most excited them.

“Probably the best topic we’ve ever done.”

“Big thumbs up!”

“Very fun!”

While some challenges and drawbacks were cited, these were few in number, and nearly all students expressed interest in continuing and seeing more console game-based learning in their classrooms.

Perceived impact

The overwhelming positive feedback of console game-based learning included benefits directly attributed to the technology itself such as:

- **Physical activity:** Being physically active while learning was one of the largest motivations cited by students. This included obvious references to games on the Nintendo Wii – where the controller operates in a much more physically active way than other consoles – but this was also referenced for projects using games on portable handheld devices like the Nintendo DS as well. This was one of the most common responses by students, even though actual game-play for each student was approximately once or twice per week.

“I like being active...we’re moving, and I enjoy that more...doing it and experimenting is the best way to learn things, I find,” P7 student, referencing a project built around the game Samba de Amigo.

- **Increased interactivity:** The interactive nature of the games, where students’ actions generated a response in the game, was a commonly cited well-liked attribute. Additionally, several students commented that they really like how the game gave immediate feedback, which often didn’t occur in other classroom circumstances where there is only one teacher to attend to many students; the game responded to the individual’s performance and ability, which was a welcome attribute for students.
- **Increased challenge:** Students reported they liked the challenge of the game, where the game provided engaging tasks that were difficult without being overwhelming or frustratingly challenging.
- **Visual:** Many students explained that the visual nature of the games not only made the learning activity more fun and engaging, but that it was a much easier way for them to learn as compared to other instructional methods they frequently encountered.

Some of the positive attributes had less to do with the technology and more to do with the nature and design of the project itself:

- **Greater collaboration:** Students reported they enjoyed working together and working as a team. Many learners also reported that they enjoyed helping other classmates when they experienced difficulties, and the support and encouragement they received from team members during game-play.

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– **Student-driven:** Being able to help create the learning experiences and the learning tangents the class next embarked upon was seen as a strong positive attribute to this pedagogy by many students.

“You’re not told everything exactly as you need to do it, the teacher guides you but then lets you get on with it,” P7 student, referencing a Band Hero project played on the Xbox 360.

Of all the positive aspects identified by learners to console game-based learning, the most critical was the impact on learning and concepts and topics were explored more deeply because they were connected through the project theme:

– **Connections:** the game served as the core or storyline to the project, upon which all the other classroom work was built.

“It was a really, really good, fun way of learning...everything we did linked up to the game,” P7 student, referencing a project built around the game Samba de Amigo.

“I think really it prepared us for the amount of independent learning we’d have to do for the next year because you’re not spoon-fed things anymore, you have to work yourself—and [the game-based learning project] enforced that,” S4 student, referencing a game-based learning project using Phoenix Wright on the Nintendo DS.

Perceived learning outcomes

The students were convinced that they were learning through these approaches. The following section summarises their understandings of these learning outcomes:

– **Content:** such as in maths, for example budgeting and money; countries and culture; history; art; dance and movement; and so on. Students were able to articulate many of the learning outcomes targeted by the curriculum maps for the projects.

– **Teamwork:** This was one of the most commonly cited positive attributes to the console game-based learning projects - the opportunity to work together, to share responsibility, to lean on one another when stuck, and so on. Many students were quite enthusiastic about this quality, describing it as though this was something they frequently didn’t have the opportunity for in usual class.

– **Cooperation and collaboration:** In a similar vein, even when not in teams, students explained that they were now better able to get along with, make friends and work with people they otherwise didn’t know very well or had not got on well with before.

“I fell out with a girl but we learned to work together for the game,” P7 student, referencing a project using Guitar Hero.

– **Concentration and focus:** The ability for the game to sharpen focus and concentration, both in the short term and over the long term, was a commonly cited impact of the game on perception of students’ ability to learn:

“But see, since I’ve been playing the DS for quite a while, I’ve been noticing that I’ve been able to concentrate a lot longer, just ‘cos I’ve been used to playing for longer, but I’ve just been able to do things for a lot longer, because I used to write a story and then get bored, then start writing about shoes...anything. So it’s not just the game that you’re concentrating on better, you’re saying that that’s applying to other situations—that you’re more settled,” S2 student, who participated in numerous DS game projects.

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“Because we could spend like 10 minutes before we actually get studying, because people like John and with their concentration, when they play like even for 10 minutes, they can have more concentration than they would have,” S2 student.

- **Creativity and imagination:** Several games were cited as helping learning become more creative and helping to generate more ideas. Games like Little Big Planet (which challenges students to design their own video game) as well as game-based learning projects like Guitar Hero (where students were frequently given design tasks such as creating a band logo and persona) were referenced by students as helping them be more imaginative and creative overall.

“It helped me come up with loads of ideas,” P4 student.

- **Coordination, arguing your case, patience, responsibility, organisation, confidence, life skills...and more:** The skills and learning described throughout the student interviews was a seemingly endless list. Many students described being better physically coordinated as a result of the game-play. One student commented that what he improved the most at was being able to successfully argue his case, “putting your point across in a civilized way.” Confidence in game-play and other class activities, such as speaking in front of the group, was also a common response. Organisation and responsibility were frequently mentioned by students participating in larger themed projects (such as projects built around Guitar Hero and Samba de Amigo) where larger group projects had to be coordinated by team members. Various life skills were mentioned as well, from basic tasks, such as booking a flight, to learning how to make tough decisions and mend relationships.

- **Failure:** a curious outcome of the projects was the impact of failing in the game being transferred to other areas of life. Students described experiences at home where they made a mistake or were unsuccessful, and how they had a changed perspective on the experience as a result of the game-play.

“I burnt a cake at home and learned that it’s just life—you have to cope with it not going right...and the topic helped us with that and keeps us from getting bad tempers,” P4 student, describing a project based on the game Cooking Mama.

Perception of learning

Perhaps the most common response of students overall was the curious realization during the game-based learning projects that “learning was fun” and that they were “having fun but learning at the same time and don’t even realize it.” Time after time, students articulated this as though it was a new and profound realization for them.

“It has [impacted how I learn], because you don’t realise it, but you’re kind of learning the same way as you usually do without a Wii game, but it’s just...it feels like you’re having more fun with it. So it has kind of changed, because I know that now it’s pretty much the same, so now I look forward to school a lot more,” P7 student, referencing a project based on Samba de Amigo.

“But sometimes you don’t realise that you’re actually doing like educational things and work. But you really are — like you’re doing just as much as you probably do if you’re not playing it. But you still get time to have fun as well,” P7 student, referencing a project using Guitar Hero.

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While a few students explained that they liked working alone, most reported that being able to work with others to complete the tasks was a huge benefit.

Writing

As the teachers have described, impact on writing for many students has been one of the most dramatic outcomes of many console game-based learning projects. Many students are quite aware of the impact it has had on their writing as well — not only in level of enjoyment, but in quantity and quality of their work as well.

“You enjoy writing more ‘cos your mind’s in the game so it’s more fun,” P7 student.

“[The project/game-play] encourages us to work — instead of being bored writing in the jotter, it’s fun playing the game and the better you get it encourages you to play more and want to write,” P6 student, referencing a project built upon Guitar Hero and Endless Ocean.

Student explanations on the impact of game-based learning on their writing allude to the notion that the game experience creates a rich world that they are able to visualize in their head, from which they are able to write about.

“You learn how to write, it helps you see the pictures better in your head so you can write about it then.”

This impact was observed even with very young writers; in a primary 1 lesson where Nintendogs was being used, several students played the game for just a couple of minutes or not at all, choosing instead to use their class time to write pages about their virtual pet.

Student voice and learner role

Some students noticed the impact this pedagogy had on their role in the classroom. In many of the larger theme-based projects where the game is used as the storyline or the theme upon which all inquiry is built, teachers and students explained that over time the direction of the inquiry is co-developed as a class, based on students’ interests, questions and areas of momentum in the content. Other students explained how the game-based learning project they encountered contrasted with their traditional classroom activities, placing more emphasis on their role, and activities are often more student-driven and directed. Students have more say in the direction and progression of the learning and tasks, but teachers carefully guide the facilitation of this by balancing the curriculum and learning goals with student interests and motivations.

Challenges

Many students commented on how participating in the project could be difficult but often clarified that this was not necessarily a bad thing - that although difficult, the challenge associated with it may partially be contributing to the success of the project.

The ability to distract students from class work was something noted by researchers during classroom observations, albeit not often a considerable problem. Often those students seated closest to the screen where the game was projected would have difficulty maintaining focus on their work. This was something commented on by several students interviewed:

“Sometimes the game distracts me from working, I want to sing along,” P6 student, referencing a project using Guitar Hero

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Some students commented that they felt bored several weeks into the project; this was noted in projects where activities largely didn't diversify or progress with the project. This demonstrates the critical difference between these projects and those that dynamically change over the course by actively respond, through the teacher's direction, to students' interests, motivations and questions.

Game-based learning versus other pedagogies

“You get to know classmates more than other class projects,” P7 student.

“It's good to get a break from pencil and paper,” P7 student.

“It's much more relaxed, we don't have to learn everything from a book,” P6 student.

When asked about how this approach compares to their classroom learning experiences to date, students were highly enthusiastic about console game-based learning and felt it was a refreshing addition to the learning experiences that they are presented with in school. Many of the reasons for this are the aforementioned attributes of the game and the project design, which for many students, were seen to be in contrast to traditional pedagogies. Student responses also pointed to the immersive nature of the learning generated by many games.

“I like working inside a story,” P7 student, referencing a project built around the game Samba de Amigo.

“It was more fun than just learning out of a book or learning for your lesson, you were actually simulating what would happen and stuff,” S4 student.

Summary

Overall, students were very positive about game-based learning—with the game play itself, but even more so the learning and activities that were built on this approach, commenting on the increased connections in learning, greater collaboration and teamwork, and the student-driven nature of the projects. Students also reported a perceived increase in understanding the various content areas explored through game-based learning, and other benefits such as increased concentration, focus, creativity, communication, organisation, and so on. Some students commented on their observations of how this impacted their learning, their ability to learn, and their capacity as a writer. At the same time, many students are also aware that the game itself can be a distraction in class if it is too close to where they are sitting. Overall, most students responded that they greatly prefer this methodology to others used previously in the classroom; while at the same time advocating that it be used in balance with other approaches.

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Students interviewed in this project spanned a wide range in terms of the time spent on console game-play at home, ranging from not at all to every day, often for several hours at a time. However, most students owned between one and three console game platforms, with play occurring several days a week for short periods (roughly 30 minutes to 1 hour at a time).

Of these differences, students seem to favour game-play in school due to its social and collaborative components, but also due to its cognitive engagement. While some students wanted to enjoy game time at home as a relaxing activity, 'lack of learning' was a strong theme amongst students who were already gamers at home. Interestingly, this has impacted on game-play at home for many students.

Game-play at home versus school

Given the opportunity to contrast game-play between home and school, students had several interesting observations, which often cited both the positive and negatives to both (see Figure 2).

	Home	School
Social component to play	Independence – you can play and explore at your own pace in your own time, without distractions.	Support from classmates – teamwork, working together to solve problems and puzzles, and encouragement from classmates were all seen as large positives to game-play in class that is not an outcome in home play.
	No pressure – without others observing and participating, there was no additional pressure to perform or fear of failing.	Increased competition – generally perceived as a positive benefit and a motivator (ie seeing who can get the best score in Brain Training).
Work associated with the game	Not having to work and just enjoy the game was more attractive to some students; “[school play] is a wee bit more boring, ‘cos you have to write stuff down, and you don’t have to do that at home.”	Students explained that they like being challenged in school by the work, and it was often more enjoyable because it was more meaningful (having been incorporated into the context of the game and storyline of the project).
NEGATIVES	Lack of learning – students observed that games played at home (at times the same titles as those played in school) do not bring with them the same learning.	Diminished play time – class time on the actual game itself was often very brief (roughly five – ten minutes, one to three times per week), whereas game-play at home could usually occur for longer periods and more frequently if desired.

Figure 2. Student perspectives on benefits and drawbacks to console game-play at home versus school.

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Impact on home game-play

The introduction of console games into the classroom has had a mixed impact on student game-play at home. For many students, game-play in the classroom has made no difference to game-play at home, with several students explaining that they play different games at home than those at school. A portion of students cited increased home play, due to the desire to get better at the game they are using in the classroom and/or the enjoyment they have found from game-play in the classroom. This has also led to the impact on some students' home play, with several students citing that they now 'learn' from games at home and look for similar exploration and learning opportunities in the games they play at home.

—
"You begin looking for things in other games...that you can learn from," S4 student.

A large portion of students responded that they play games at home less as a result of game-based learning in the classroom, explaining that home play has become less fun or that they get their 'fill' of game-play in school so they don't feel the need to come home and play as frequently.

—
"You play it less, 'cos you feel like you've had a go at it, so you do something else...or you play that game, but you don't really enjoy it 'cos it's not the same as at school," S2 student.

Students' perceptions of parental view

Of students who play games at home, many noted that their parents do as well and will often play along with them. Occasionally, students would mention that one or both parents do not like gaming as a leisure activity for them.

According to students, parents' perspectives on console game-based learning in the classroom were largely positive as well. A minority of students explained that their parents probably did not know that this was occurring in school and a small number of students also reported that their parents were sceptical of the project when they first heard about it. However, after learning about the project and seeing the work covered, they are now supportive. In explaining this scenario, several students commented on how they were able to explain to their parents exactly what they were learning and why it was valuable - an interesting outcome on student achievement for this pedagogy.

By and large, most students reported that their parents were quite pleased about the game-based learning project. Explanations for this enthusiasm included:

—
"They are quite pleased that I'm not just copying what the teacher said," P4 student.

—
"My mum thinks it's quite good, 'cos everybody's bonding and focusing on their work," S3 student.

—
"My mum didn't think it was good at first, but then I told her about all the work and now she's like, 'It's a great idea'," P6 student.

—
"My mum and dad, they weren't sure at the start, but when I went home and told them how we're doing all this Excel and all this new writing and CVs and autobiographies, now they do think it's a really good way of learning as well," P7 student.

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Overall, student respondents were aware of and able to articulate a considerable amount of positive learning outcomes from these experiences in game-based learning — skills that are not only commonly identified in core curricula, but a heightened awareness of themselves as a learner.

Student response to the console game-based learning projects was very positive. For most student responders, not only was the technology itself stimulating, rewarding and engaging, but the more robust projects built on game storylines were even more so. However, the distraction associated with the game as well as some repetitive tasks of the project were seen as negatives by some students. With this overwhelmingly positive response, it is important to highlight a caveat to using this approach in the classroom, as articulated by many students.

Students like game-based learning, but they also want balance. Numerous students felt it was important to emphasise that while they greatly enjoy console game-based learning, that they would not want their entire school experience to be designed this way. Some noted that they like traditional textbooks, and many explained that too much game-play would be boring and lose its appeal.

“We like the mix — that we get time on that as well as with books,” P6 student, referencing a project using the Nintendo DS game Professor Layton.

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Meldrum Primary School: Inspiring learners through Guitar Hero

Inverurie, Aberdeenshire

www.meldrum-pri.aberdeenshire.sch.uk

P1 – P7, 306 pupils

15 permanent teachers, including two Depute Heads and the Headteacher, plus Visiting Specialists of Art and Learning Support

Console games used:

Nintendogs	Wii Music
Endless Ocean	Guitar Hero
Cooking Mama	Just Dance!
Samba de Amigo	



and the class began building the project context — students took on the persona of rock stars, created a virtual band called Full Moon, and began the first Design & Technology project of creating their own guitars (designed to scale) using cardboard and other various materials.

The P7 teacher helped the students set up a guitar shop, charging students with the task of writing adverts to sell their guitar — which placed emphasis on developing persuasive language. The class was able to keep extending the storyline into classroom work in numerous ways. For example, after attending the Choices for Life event in Aberdeen where live DJs play, the class decided to build on the notion that Full Moon had played this event and wrote full newspaper reports describing the show. Students wrote and performed Full Moon's first single using musical instruments and as a result of their curiosity about the nature of sound, embarked on a full science investigation of the topic.

The class even incorporated drama into the project, recreating the Brit Awards. The teacher designed the next phase of the project and student groups researched a country that was included on tour, writing letters back to UK fans telling them all about Full Moon's time in each country. At this point, the project was no longer teacher-led but student-driven.

The students next decided they needed a band website, which ultimately posted biographies and reports from their concerts in Paris and Brussels. Pleased with the website's design, the class decided that its launch needed to coincide with the release of the single, and they would need to do an advert for the TV — which they created with a start-stop animation using Plasticine figures. Overall, Meldrum was very excited by the outcomes and impact of this pilot, and encouraged to consider this pedagogy further.

Background

Three years ago, the school participated in a pilot project with the LTS Consolarium. In 2007, Primary 7 teachers were first to pilot a project using the PlayStation 2 game **Guitar Hero** (where players take on the persona of a rock star and compete to play the songs appropriately with the special 'musical' equipment that comes with the game) hoping it would help keep learners engaged in their last term in primary.

Guitar Hero: Piloting a Game-Based Learning Project

With support from the LTS Consolarium, Meldrum Primary embarked on creating a project around the game. After receiving the borrowed game, console and guitars, the P7 class was introduced to **Guitar Hero** — first through several class periods of free play to get used to the game. Game play was then built into a weekly rotation

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The Game-Based Learning Journey

With the success of the first pilot, the Depute Head knew they were onto something and decided to pilot another project in the following year. Again with support and borrowed kit from LTS, the pilot ran with P6 students, using the game **Endless Ocean** - where one explores a virtual coral reef to learn all about sea life. Learners were put into pairs as 'dive teams' and conducted rich, extended learning projects around this theme - which resulted in similar effects and outcomes. Today, Meldrum Primary has game-based learning projects embedded throughout the school, from a P2 project using **Nintendogs** on the Nintendo DS to rich, extended projects in P5, P6 and P7 using games like **Kororinpa** and **Samba de Amigo**³. The success of these game-based learning projects is specific to the contexts generated by the games; Meldrum has explored other theme-based projects such as Harry Potter and recreating the Great Hall in the classroom "but... they're not immersed in it in the same way."

The pedagogical approach

After running numerous game-based learning projects over the past several years, here's Meldrum Primary's general approach to successful implementation.

Curriculum

Using the theme of the game, the teacher creates a concept map of project ideas and curriculum areas to cover. In the beginning of the project, the students create one as well. Each project/game has natural or obvious starting points, but as time goes on the students' interests and inquiry leads the direction of the project and you follow where the learning goes

— natural questions and areas that need unpacking come, which creates new additions to the concept map: "If you listen to what the children want to learn and where they want to take it, it opens doors that you probably haven't thought of either." Generally, the projects have spanned six or eight to ten week blocks, so that the children have an opportunity to explore many connections within the context the game generates. Teachers commented that this works well with the flexibility offered by the new Curriculum for Excellence. While core work in spelling, maths, etc must continue, teachers at Meldrum have found that most curriculum areas can connect to any project; the exception noted was religious education, and teachers advised against making contrived curriculum links as it dilutes the project for the student.

Glow has also been a useful tool, not only for teachers to get ideas and contribute back what they have created for these projects, but by creating class pages where students start discussion threads on various topics related to the project and upload their work to share as well. Teachers have then used these discussion threads to help determine where to take the project based on student questions and interests.

The role of the game

When introducing the game, time is allocated to provide several opportunities for each student to play before really diving into the project. While it is not long before the novelty has worn off and students can successfully engage with the game without distracting student learning in the classroom, they will at first be quite

³ See <http://ltsblogs.org.uk/consolarium/2010/02/24/consolarium-podcast-5-samba-de-amigo-inspired-learning/>

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excited and distracted by the novelty of playing the game in school, so this pre-project game time is important.

The nature of game-use throughout the project varies by the game, the scope of the project, the unique learners in your classroom, and so on. Generally, teachers have found that one or two opportunities for game play per week is enough generate the buy-in to the storyline, and that over the duration of the project this often subsides — where students don't need much game play at all as they are fully vested in the project.

Classroom management

This aspect should be carefully thought through before initiating a project; how are the children going to access the game? Are they going to play in teams? What kind of game is it? How can you make sure that everyone is involved? In the lessons observed for this review, students were well into their game-based projects and comfortable with class routines; often without being prompted, students would independently rotate onto the game individually, in pairs or in teams as dictated by the rota.

Arrangement of the classroom

Since many of these projects divide students into teams or work groups, classrooms are arranged in tables of around four students each. In this way, students are seated at tables that provide ample workspace for project tasks, and teams can easily collaborate. The positioning of the screen where the game is displayed is of concern, as students seated near it can be distracted at times. Most teachers have taken the approach of rotating which students are seated near the screen.

Parent communication

Since Guitar Hero is rated "12-plus," the staff at Meldrum sent out a letter explaining the nature of the project to parents before it began. However, there has generally positive support of game-based learning by parents, where they can also see the progress and updates in the project on Glow.

Impact on learning

Learners in the pilot were not only highly engaged but they were helping lead the direction of the project and the inquiry that was conducted. The outcome was more successful than the Depute Head had ever anticipated, as she explained, "these kids were in at 8.30 in the morning, in at lunchtimes...they couldn't get enough."

What led to such a dramatic impact? According to the Depute Head, "it creates a collaborative story that everyone buys into...and then you have a community of learners who are in this context and everything comes out of that context. It links up. It's relevant. Everything means something." The impact of this buy-in was quite dramatic: "I had one parent phone me prior to **Guitar Hero** telling me her daughter doesn't really want to come to school anymore. That student was here at half past 8 practising the drums ready to record the single she was performing. It's just incredible."

Being a pilot project, the Meldrum staff were particularly alerted to the effectiveness of the project and looked to the students' work to gauge this. Within the project, school staff observed the emergence of student-led learning as well as numerous skills being targeted and developed — including collaboration, communication, investigation, and problem solving, as well as transfer of learning. According to the Depute Head, "the whole package changed the dynamic of the classroom."

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Of particular interest with the pilot was determining if it could impact on students' writing - since getting students excited and engaged in writing, particularly boys, was a challenge. "Prior to Guitar Hero I would say, we're going to do some extended writing today and it was like watching a blind come down."

Not long into the Guitar Hero project the Meldrum team noticed a distinct difference, "I said right, we're going to learn to write biographies today, but it's an imaginary rock star...and suddenly wow, the boys want to do this!" The impact was evident in the quality **and** quantity of their writing.

The project had a notable impact on student behaviour as well. Students that were not confident with IT before were eagerly participating in the design of the website. Students who previously would have difficulty staying on task and presented minor problems behaviourally were now immersed in the activity and no longer disrupting class. The accessibility of the game makes it easy for everyone to get involved and contribute; "three children from our curriculum support unit which are boys with specific learning difficulties...and they come in and they'll just pitch in, and just you're on the same level as everybody else."

Elrick Primary School: Engaging young learners with handheld games

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Westhill, Aberdeenshire
www.elrick.aberdeenshire.sch.uk

P1 – P7, 356 pupils

Console games used:

Nintendogs	Rock Band
Guitar Hero	Nintendogs
Endless Ocean	Wii Yoga
Brain Training	Wii Music
My Word Coach	
Professor Kageyama's	
Maths Training	



Background

After being introduced to console games nearly five years ago at a conference, the headteacher at Elrick Primary felt there was great potential in console game-based learning. School staff were focused on more traditional teaching methods and as a result, the headteacher, in conjunction with the Local Authority's Glow team, introduced a greater range of ICT activities to involve staff and help increase their confidence in using ICT. Regular ICT training opportunities were introduced, as was a monthly session on Glow, and frequent opportunities for staff to collaborate, share and coach one another with ICT activities were also established. This approach fitted well with the schools emphasis on professional learning and collaboration.

The school got involved in several trial projects through the Local Authority, which helped build confidence in the staff as well as demonstrating the potential in using ICT for learning. Smart Boards were installed in every classroom, and soon after the school also

purchased ten Nintendo Wiis. The first full console game-based learning project was led by the Deputy Head using Guitar Hero - the success of which spurred enthusiasm for this approach in the school, and served as a future model for the P7 teachers.

Elrick piloted their second console game-based learning project with P7 students using an easily accessible game like Rock Band and it proved to be successful. The approach was slightly different to that used for the Guitar Hero project, as the class was divided into 'bands' or working groups, and the first task of the project was to write a CV and apply for a 'band job' (which musical instrument to play as well as role in group, such as 'Band Manager' or 'accountant' - which helped designate which project tasks each group member would lead).

With the 'bands' now set, the class created the parameters for the project together, co-constructing answers to questions such as: "what will we do if someone in your group isn't working, or if they keep getting distracted by the game?" Game-play was structured into the class schedule twice a week, with one short period and one long. From there, the teacher led the activity planning by taking the curriculum outcomes and making connections to the context of the project - which she described as straightforward.

Throughout the project, countless curricular areas were covered. Since students earn money for their band through playing the songs, they incorporated maths (such as budgeting and tracking spreadsheets, etc). Students were also charged with managing the band like a business, so there was lots of decision-making required. Elrick's approach to this project also introduced 'band mail' to generate more interest than just the game, where bands would receive letters from individuals asking for demos, and the bands had to submit one to the recording company ('owned and operated' by

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the P7 teacher). This scenario created the opportunity for many higher-order skills, such as negotiation, when bands had to come to agreeable terms on their new recording contract.

The positive success of early pilots was encouraging for the team at Elrick Primary, but could the same outcome be achieved with much younger learners?

'Nurturing' Nintendogs in Primary 2⁴

Despite initial success with the P7 projects, when LTS approached Elrick's headteacher about piloting the use of the Nintendo DS game Nintendogs, she did have some initial concerns and reservations. These included concerns relating to parent perceptions of game-based learning.

About Nintendogs

A real-time virtual simulation game for the Nintendo DS, where players use the touch screen to play with, train, pet, walk, brush, and wash a virtual dog. With the microphone that is built into the DS, the player can create voice commands, which the puppy will understand and, if properly trained, follow.

With a parent communication plan in place, the Primary 2 teacher was given the game and the challenge of creating the project: "it was a bit of a panic...it was really scary." With eight Nintendo DS consoles, the teacher decided to put the students in groups of three and would rotate turns throughout the day getting to care for the virtual pet.

By linking the game to language it was generally set up during writing time - about three times per week for a total of an hour.

As the project got off the ground, the teacher's concerns were assuaged: "As soon as it started you could see it, and as you just go with it...the children will lead it." Students were excited and doing well with the project: "The whole school was talking about the project, and there was a real buzz about it."

The challenge of the game and the collaborative nature of the project provided formative opportunities for the students to learn how to work together and problem-solve. One group of three really struggled and the dog was getting fleas (a sign that the dog is not being adequately cared for), so the group needed to come together and figure out how to work better to get the dog healthy. "I even had a parent come to me concerned that it wasn't working...but I explained it was, because it's presenting them with the challenge to overcome." For the teacher, this was a real chance for reflective thinking and team-building.

Indeed, during the project parents did voice concerns - about what learning was actually occurring and that their children were spending far too much time on these devices at home already. However, Elrick staff frequently communicated with parents and even set up blogs so that parents were well informed as the project moved along. Parents were also invited into the classroom to see what the project actually looked like and students even actively demonstrated the game at 'parental involvement conferences' hosted by the local authority.

⁴ Case study available on LTS site:

www.ltscotland.org.uk/sharingpractice/g/gamebasedlearning/introduction.asp?strReferringChannel=usingglowandict&strReferringPageID=tcn:4-487084-64

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The greatest impact from the project was the development of writing and collaboration skills. After game-play, students would write in their Learning Diary about what they did with their dogs. "I saw a huge impact on their writing, because it was meaningful for them. Often it's so difficult to get them to go to the writing table, but with the project they would write pages."

The game-based learning journey

With each successful project, Elrick Primary moves further along in developing their console game-based learning approaches. While the learning outcomes in the classroom have been one of the biggest drivers of this initiative, the impact on professional practice has been one of the most dramatic. "I would definitely say it has changed me as a teacher. I see myself far more as a facilitator. When I ran the project it was my second year teaching, and I would have perceived teaching before as you stand at the front but it's changed me completely. Now I do most everything in group work, and I'm guiding from the back."

Reflecting on the nature of console games as instructional tools, one P1 teacher cautioned, "Don't come in with any preconceived idea of what you're going to get out of it. The game is a tool for learning - you still have to rely on all the other skills as a teacher. The game itself is not enough."

Overall, the headteacher said that the greatest achievement of the initiative was the increase in confidence with ICTs that both she and her staff had experienced alongside a greater reflection on pedagogy. The teachers describe a collaborative ethos at the school - where plans are shared, classes are frequently observed and teachers know they can lean on one another when trying a new game-based learning project. "We make it a very transparent process, and that's really helpful," described P7 teacher. "It's good for people to come in and throw out their concerns, so you're

constantly evolving your practice." With a few trailblazers leading the way and spreading the enthusiasm, the school staff can be sure to move forward together - as a professional learning community - encouraging all staff regardless of where they are in their capacity to use console games in the classroom.

While technology costs can be a challenge, Elrick has been able to purchase some of the lower cost equipment such as the games and some Nintendo kit, and to supplement this they also borrow from their local authority.

Moving forward, the headteacher and trailblazers will keep a keen eye on what new games and approaches are coming along, and use the LTS Consolarium as some of their main contact points. The overarching guiding question is always "What is the benefit for the learners?"

The pedagogical approach

Recently running the Nintendogs project again with P1 students, below are some classroom practices that have proved to be successful in Elrick Primary.

Curriculum

The game can be a great stimulus for writing, and therefore is often tied into language time. However, many extensions and activities can be made, including building a class pet store where maths and life skills activities can be built in. Typically the project runs for about five weeks, as it begins to lose its impact after that time and the kids become bored with it.

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Classroom Management

Putting students into groups to manage one virtual dog creates the opportunity for teamwork and collaboration. Rotating stations works very well, where one-third of the class will have an opportunity to engage with the game for up to 20 minutes if they choose while the remainder of the class works with the teacher or at other stations.

Arrangement of the classroom

Students are encouraged to take the handheld console and play where they are comfortable — often on beanbags in the carpeted space in the back of the room. The writing table is also set up with their Learning Logs (jotters where they write entries on what is happening with their virtual dog) so that they can move onto that when they have finished with the game.

Parent communication

Frequently communicating and providing opportunities to see the project has worked very well, as has the blog established for this purpose. These strategies are particularly more important in younger age groups of students who may not be able to explain the learning associated with the game as well as their older counterparts.

Impact on learning

Overall, the console game-based learning approach has been a means for not only developing key skills but for accessing the new curriculum: "It's just a tool...the tool itself is not where the learning comes from...it's just the vehicle...to start building or improving upon or building knowledge and interest ...it's what the whole Curriculum for Excellence is about."

Motivation and engagement are again one of the greatest areas of impact for Elrick Primary, as well as application. "They're applying their learning in real world scenarios. Some things you have to introduce first, then bring in the game scenario, other things you can just jump right into in the storyline of the project."

In the Nintendogs project, the impact on writing for such young learners has been quite dramatic, where students are electing to write in the Learning Diaries even when it is not required. Reflecting on a recent lesson the P1 teacher explained, "I can't believe how many students just got to work on their writing — I offered that as an option but didn't expect it and I can't believe how many students opted to do it on their own." Of particular note is the improvement and engagement with writing by boys in the class and students who have had behaviour problems. "I even had one girl say one day not long ago that she didn't even want to play with the DS she just wanted to write about her dog because she is so invested in it at this point."

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Longhaugh Primary School: On a mission to engage learners

Fintry Terrace, Dundee
286 pupils

Console games used:

EyePet
Endless Ocean
Little Big Planet
FIFA World Cup
Gardening Mama
Sims



Games-based learning has been a recent development at Longhaugh Primary. Although the headteacher had considered console gaming as a possible pedagogical approach for several years, it wasn't until receiving the gift of a PS3 in December that the headteacher initiated game-based learning in the school.

Not long thereafter, the headteacher approached a P3/P4 teacher with an interest in game-based learning. Despite some challenges including the teacher's inexperience and pupil behavioural issues, an eight-week pilot project was established. Although she had a challenging class with some behaviour issues, as well as it only being the teacher's second year in the classroom and she was not a game-player, they were still eager to try it out: "I sent it home with her one weekend and she came back buzzing and full of ideas." From there she put together an eight-week project that was strictly timetabled: "Ultimately, there was very little actual time on the game - but they loved it."

Not long after the conclusion of this project, the headteacher announced at a staff meeting that all teachers were to do a console game-based learning activity next year, and soon held a half-day exploration showcase where teachers could see the games and brainstorm ideas for how they might be used - which proved very

effective. As a result, numerous staff members have taken on game-based learning projects in the final term of this year.

Partnering in primary with Gardening Mama

One project used the game Gardening Mama with two P1 classes. LTS offered to loan out a set of Nintendo DS consoles to the class but the teachers had initial reservations about how this type of device could promote collaborative learning. Additionally, the expense of the units was a concern as teachers were unclear how to progress game-based learning if they did not have the opportunity to borrow the DS units in the future.

About Gardening Mama

A simulation-style game for the Nintendo DS, players use the stylus to plant bulbs, dig trenches and water plants. The main mode of the game, 'Let's Get Growing' encourages the player to successfully grow and maintain a variety of vegetables and plants in a garden.

The two teachers decided to pair up and pilot the project anyway, hoping that together, their collaborative creativity would design solutions to some of their instructional concerns: Since many students do not otherwise have access to gardens, the teachers wanted to give these children the chance to garden, and to game.

In order to enhance the collaboration students were paired in each class, per DS unit. This approach proved very effective for both the students and the teachers: in these pairs and amongst other groups, teachers frequently observed peer-tutoring on the game and the work occurring, "which builds up connection and collaboration

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amongst students — and there's no shame in asking questions." Partnering for the teachers has made a considerable difference as well — not only for creative planning purposes, but also for coordinating activities and managing groups.

Although they embarked on the project as a team, each teacher had a slightly different approach in class: one let the children play with the game independently, after briefly guiding them to the correct activity and supporting as needed; the other directed the activity initially much more by providing demos of each stage, making sure each child was on the right screen then in the right place, doing the right activity — then when all were on board she supported in the same way.

The project was designed to focus on literacy, where activity in the game was recorded by each student in a shared game log. The other critical component was the fact that this game-based learning project was occurring alongside a school-wide task of building a community garden. This was a tremendous opportunity for reinforcement and connections. Language lessons in classes built sentences using words from the game, and the game relived the experience of the activity in the garden. During one lesson in the middle of the project, a student looked up from his game console and explained to the teacher, "I was just doing this outside!"

Motivation in learning has dramatically increased according to both teachers, who explain, "They enjoy reading what their partner did the day before in their gaming books." The nature of the game and pairing students has contributed to this:

"The game activity helped develop many different areas of skills. Students learn vocabulary in the game, and are more willing to try using the words learned in this context over those in their books because of the confidence they gain from the game-play. A lot of

children who don't gain success and find writing and reading difficult will try again when they know they aren't quite doing it right. Gardening Mama will fix it for them, so they don't get discouraged but they know they need to work on it and they will... they just keep trying."

An additional unintended but observed area of development is that of fine motor skills - using the stylus and using their thumbs with the game. "A lot of the tasks require precise placement and the children have become really good at this."

Perhaps the greatest connection for the project was the community garden the school has been building. "We have bought a lot of strawberry and vegetable plants...the children have been growing them, and they come in and say I've been growing these outside. It's given them a lot of experience and they're able to use their knowledge in different situations and transferring their skills." The classes have connected the project to real life in other ways as well, by visiting a garden centre and recreating their own garden centre right there in the classroom, which builds the storyline, engagement, and real world connection for the students.

The game-based learning journey

Although Longhaugh is still very early on in their console game-based learning journey, the school is full steam ahead: "My dream is to have a games console in every class - permanently," says the headteacher. The school has decided to focus on acquiring PlayStations and Wiis, mostly for their cost, the games available, and the nature of game-play associated with them. Although content-specific games and training games are often considered easy targets, it is not the direction the headteacher would like to go: "I'm less comfortable with a game supporting a topic. I think the topic should be the game, and the curriculum areas plug into it."

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The headteacher explains the nature of his school: “We’ve got 44% free meal entitlement, which is fairly high. And... we’re one of the poorest wards in Scotland...so it’s difficult, we’ve got a lot of social and economic problems. We’ve got a lot of problems, we do have challenging behaviours in every class.” For Longhaugh, capturing students’ attention is not easy and is the key for many learners. “We have a school where we need to capture their attention, and pen and pencil won’t do it anymore. As a motivational tool, it’s been unsurpassed.”

While many Longhaugh staff are convinced, and the local authority has been very supportive, the headteacher hopes to draw further on support like Glow and the LTS Consolarium as the school collectively moves more towards this pedagogy. “Game-based learning needs to be developed, but it’s clearly one of the key strengths of the school. Easiest way for getting Curriculum for Excellence in...it’s so simple.”

The pedagogical approach

Start with an open mind. Every game-based learning project evolves in its own unique way, depending on the game, the context, the students, and more. Going into the project with the mindset that you’re exploring what can happen is important, and much of Longhaugh’s success started with a headteacher who not only supported but encouraged this freedom to try and test new innovations.

Spend time learning about the game. While some console games may not require this, the teachers using Gardening Mama lamented that they didn’t know every in and out of this game before starting the project, in order to better plan activities and curricular connections, and better support the children on occasion. Before starting the project, take some time to explore the game yourself.

Organisation

Being very organised from the start is important, but particularly so with very young learners and with a project that involves so much mobile technology. In preparing for the project, allot time for preparing the handheld consoles for use — teachers noted that having to get them all out the boxes and charged “took an absolute age!” Make sure the children know the game, know their partners, where to get the DSs, etc. Managing all the DSs can be a challenge; get comfortable with how you will make sure they are all charged, how they will be stored and retrieved by students, and the logistics of how to manage class time with them. Take some time to think this through, and remember, the students can be a big help with this!

Arrangement of classrooms and adjoining area

The children had clearly defined areas where different activities took place, and they were very comfortable with the routines. Gaming with a small group on the carpet allowed the teachers to interact easily with individuals, and brought the children physically close to one another so that communication and collaboration were facilitated.

Parents

One effective means of communicating with parents was a notice board on the door to the classroom, describing the various stages of the project—that way, even in a rushed visit to the classroom the parent can quickly glean what’s happening in their child’s learning. In this project, parents could come informally into the class every Wednesday to see what the children had been doing, but there were also more structured times advertised when they could come and see specific activities, such as the children’s garden centre and their class assembly.

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Impact on learning

Even with these early pilot projects, some of the biggest impacts Longhaugh has seen is on the children's response to the approach: "Their motivation, wanting to learn, working together, feeling proud of what they've done and what they've grown" — all greatly increased their confidence as learners and coaches to peers. Teachers repeatedly noted that they would see children helping each other, and even though they used individual game consoles, the students took on a collaborative, communal approach to achieving success: "One girl was guiding others because she had reached a level and could now show others...and we encouraged children to 'ask the friend next to you'." Although the P1 classes have completed gardening projects in the past, the game "was a great teaching aid... it added a dimension that we hadn't even thought of, and would be keen to include in future."

The motivation and engagement of the game across classes at Longhaugh has had quite an impact on decreasing the number of behaviour problems. Observed daily, classroom teachers frequently saw "the concentration on the faces of some children who normally don't concentrate". This was a profound observation for the headteacher, who felt that maintaining this engagement and motivation is critical and therefore the game must continually be viewed as a learning tool and not a behaviour tool: "children are not to lose their turn because of bad behaviour."

For the headteacher, the biggest benefit has been the dramatic changes in the organisation and management of the older classes. For him, the interdisciplinary, thematic way of working, so effective in the early years, somehow often gets lost in older stages. Yet with game-based learning he truly feels that has now been rediscovered by the upper school: "That's what active learning is in my view...they weren't writing a report for a textbook. They were writing a report on something that they [had] actually done...to me that's active learning and that's Curriculum for Excellence - absolutely."

Lairdsland Primary School: Spreading console game-based learning

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Kirkintilloch, Glasgow

www.lairdsland.e-dunbarton.sch.uk

266 pupils

Console games used:

Guitar Hero

Endless Ocean

Samba de Amigo

Cooking Mama

Nintendogs

Wii Tennis



Background

At Lairdsland, a chartered teacher has assumed responsibility for taking game-based learning forward. Nearly three years ago she approached her headteacher to use Guitar Hero with her class, then P7. Based on the teacher's recommendations and supported by in-service training provided by the LTS Consolarium, the headteacher agreed to initiate a game-based learning pilot.

In the first year, Lairdsland borrowed an Xbox, a Wii and ten Nintendo DSs from the LTS Consolarium - adding 15 more DSs won by the chartered teacher in a Brain Training competition. Their first two projects were 'Making it Big in the USA' using Guitar Hero and 'Puppy Dog Tails', a project idea using Nintendogs, borrowed from Meldrum Primary; a third project dubbed Wii-bleton was presented at the Scottish Learning Festival.

Following on from these projects, Lairdsland's Primary 3/4 teacher approached the headteacher about using Cooking Mama in her class, with a particular desire to draw on the world-wide cuisines

represented by the children in her class, and the chartered teacher worked with her to draw up the plans. Like many of the other schools included in this review, these early pilots had great success.

Endless Ocean

After observing the impact of the initial projects, the chartered teacher planned to begin another game-based learning project in P4 and P5 this time using the game Endless Ocean. She approached the leading game-based learning teacher at Meldrum Primary - whose work she had heard about at a recent conference - for thoughts on how to use the game. Taking and adapting some of her ideas, and pulling others from the LTS Consolarium's blog, the chartered teacher developed an eight-week project plan.

The project focused on international education and literacy with the class focusing on Australia and the Great Barrier Reef. Pupils explored the environment, the impact of people and Australian culture. "Within this context, the teacher selected the main curricular focus areas of Literacy and English, Social Studies, Expressive Arts and Technologies, with the minor curricular focus areas of Numeracy and Health & Well-Being.

To access these objectives, the class completed rich activities such as:

- Creating their own Dive Shop, where students had to research diving equipment and describe the kind of market research needed for their own products;
- Researching divers and the nature of pressure, and how this impacts diving;

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- Creating a multimedia display of their understanding of the Great Barrier Reef;
- Composing a report to a biologist on the existing damage to the Great Barrier Reef;
- Producing a travel brochure for Australia.

With the game, each student would get the chance to dive throughout the day or throughout the week, with their dive partner, for a ten minute session, and then describe what they found in their 'diving diaries'. "Quite often, if they found something, they would scream, they'd be so excited and the rest of the class would then join in and say 'Oh, how did you find that? Oh, tell us more about that.'"

The teacher indicated a range of positive impacts, most notably, in terms of student achievement:

"Much more achievement, definitely, increased in terms of their writing, and I think with their maths as well...especially since there are a few that aren't so keen on the maths and are more literacy-based pupils. Also, I think they came together a lot more, mixing through these topics as well."

Their achievement was even evidenced in a recent Glow competition with other schools within the local authority. The competition was focused on the recession, the tourist industry, and trying to get people to go and visit a particular country.

"We were the youngest class, most of the classes that took part were Primary 7s, we were the only 4-5, and basically what they had to do was make a presentation about Australia, why people should come and visit there, loads of different facts about Australia...and

then they had to present it through Glow and they actually won! So they were really impressed and I was really impressed because there was a big difference between them and the 7s and a really great outcome."

Despite the wonderful success, the teacher was candid about the challenges of the first-time implementation: "It's quite difficult, I think it could have been a lot smoother, but because it was the first time that I'd done it as well, it was all new to me. And I think also I don't think I'd given myself enough time as well...this year I knew that we needed to get things organised a bit earlier."

The game-based learning journey

Today, Lairdsland has embedded game-based learning projects across the classes and structured the entire school curriculum to make sure that every student encounters a game-based learning project during their time in primary. To facilitate this, the school now owns three Wiis, an Xbox, a number of PlayStations, 16 DSs and the software. They use the Wiis at golden time as well, so that every child in the school at some point is able to use them.

According to the headteacher, the initiative has dramatically impacted on professional practices: "You hear them talking about it in the staffroom...people are keen to get involved." The impact is something she's observed in classroom practice as well: "When I visit classrooms to monitor learning and teaching, I can see the difference in pedagogy." As a professional community, they are making sure to learn from both successes and challenges; for example, the impact of certain games has been questioned, but they are careful to reflect on outcomes, and if they are a result of the game or the pedagogy and methodology used to implement the game.

Looking forward, Lairdsland keeps a keen eye towards resources for game-based learning: "The Consolarium website and Glow group...

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brilliant.” Other schools have also become key resources: “We look at that to say, ‘well would that be good for us? And how can we adapt it?’ Because we don’t take something and just think well let’s try that...you make it work for you.” Part of what makes the overall game-based learning initiative successful is the role of champions of game-based learning in a school like the chartered teacher at Lairdsland, who has even “infected” Cumbernauld Primary by supporting their beginnings of a project in P6, leading a ‘Glow Meet’ with her P4/P5 children to get them up and running. By the LTS Consolarium opening the door to console game-based learning, teachers are working to collaborate and support one another, even across schools, helping to spread game-based learning across Scotland.

The pedagogical approach

Curriculum

Thorough curricular planning is how Lairdsland makes such rich and successful interdisciplinary projects which firmly embrace the principles of A Curriculum for Excellence: “We have all the subjects in one area that say major focus, we have all the subjects there that say minor...and we’ll choose three usually major and we’ll choose a couple of minor - but only if they work in the context of the project”.

Classroom management

One of the biggest challenges of this pedagogy can be timetabling and coordinating access to the games as needed by the classes, as was the case for most of the projects at Lairdsland. However, with Endless Ocean, the teacher didn’t need to make many adjustments to her timetable. “I tend to do a lot of the topic work in the afternoon or if I have a writing

lesson in the morning, it would be through the topic.” In terms of playing the game, students would have ten minutes a day, during various times throughout other activities in the day when they finished early or wouldn’t be missing other work; however there were always a few students where this rarely was an option so it helps to keep track. “I let them take responsibility for it. There were days when not all of them got on, but they were fine with that, at least they were getting on a few times a week.”

Helping to facilitate this was a checklist kept by the teacher and the students’ diving logs, which kept dated records of every ‘dive’ they made. The teacher’s very efficient time management was also an important factor in keeping the programme of game-play rolling, with regular time-checks helping to keep everyone on task.

Parent communication

For Endless Ocean, the teacher just used her class newsletter to keep parents abreast of the project — she felt that due to the nature of the game, pre-emptive communication wasn’t needed. However, with other projects they have decided to send out an actual sheet giving a bit of background information and, “we’ve not had any parents with any issues at the moment, I think that really helped.”

The staff at Lairdsland has also used Glow Learn – a VLE within the Glow platform – for sharing with parents the tasks and accomplishments in the classroom. It has been quite successful for them, and they look to continue using it in future projects.

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Additional advice from a P6/P7 teacher at Lairdsland, if you're considering trying a game-based learning project:

"I think the best thing to do is to go and see some and see it in action, it might not exactly be the way you would do it but...I think there's sometimes a misconception just from what I've heard from other teachers in different schools, that it's all about playing a game and it's not. It's purely the stimulus for the rest of the curriculum work that comes from it."

Impact on learning

Outcomes from projects like Endless Ocean and others used at Lairdsland are very similar to those echoed at other console game-based learning schools: "It really, really engages the children," and "The learning, it totally captures their imagination." For one P6/7 the greatest impact she observed was:

"The children, seeing how excited they are about their topics, their parents talking about it, how keen they are to learn about their culture. The things that came in from home that they did just themselves at home, it was just fabulous, we had a whole wall at one point of work that they'd done at home. They weren't even asked to do it, they just came in and I think it was the enthusiasm, just so excited, and we were talking about it last week and they're still excited about it from last year."

The use of Guitar Hero as a final term project for the P7 students has demonstrated the same outcomes and impact as it did for the students at Meldrum Primary - motivation, engagement, enthusiasm as well as the enhanced quality of work. Prior to this project, the school struggled with students as they switch-off and look forward to secondary school; but with Guitar Hero:

"You get quality work from them in that term when they're involved in that type of learning. The quality of their writing, they keep the standard up right to the last week." Teachers attribute the change in their writing due to the nature of the project: "They take on that persona and write as that character. They're that imaginative person, but actually the children really become very immersed in it. They really believe it." With such a dramatic level of buy in, the students internalize the storyline and perspective, and from there the writing flows much more easily, "and that's very powerful."

Rarely is behaviour an issue in the school. However one student who recently transferred over to Lairdsland has struggled in this area – swearing at and kicking teachers in the previous school, assaulting the headteacher. Yet not long after settling into the game-based classroom at Lairdsland his behaviour quickly modified: "I mean he's just a different child." The staff observed similar examples in the younger classes as well:

"We had a child who came in Primary 1 who had horrendous behaviour problems. We had to involve a team from within the authority to give us support. He went to a behaviour unit. In Primary 2, during the Nintendogs topic, oh my goodness. That child was so motivated about the thought ... now they don't spend lots of time using Nintendos, but just that and the kind of work that's associated with that because Nintendogs is very cross curricular. They were going to the pet shop. We were inviting people in to talk about looking after animals. All of that and using those Nintendogs his behaviour just calmed right down. It was incredible. It really was."

The benefits of the pedagogy are even evident to HMIE, who recently inspected Lairdsland and viewed student writings from the P2 Nintendogs project: "they were really impressed."

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A taxonomy of educational benefits of gaming in school

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The following categorisation of educational benefits of console gaming in school is drawn from the data collected in 19 schools. The taxonomy has been developed drawing on the perspectives of the school leaders and classroom teachers.

Benefit	Description
Active learning	Game-based learning can promote active learning in students, where teachers plan for it.
Authentic learning contexts	Game-based activities provide a context for learning which is meaningful to students and young people.
Closing the culture gap	Game-based learning has the potential to tap into students' own culture and interests and narrow the gap between home, school and elsewhere.
Collaboration and social interaction	Game-based learning can promote collaboration between teachers and students; and between students and their peers.
Communication and cooperation	Games provide the opportunity for students to communicate with each other and to work in teams whilst organising themselves to complete projects.
Critical thinking	Game-based learning absorbs students and this leads to thinking more critically and engaging more deeply with activities.

Benefit	Description
Digital literacy skills	Familiarity with games and other ICTs, particularly supported by peers and teachers, can enhance digital literacy skills.
Engagement and motivation	Games engage students and building activities around them can provide a good platform for learning.
Improving relationships	Game-based learning can improve relationships between teachers and students because teachers may need to rely on students' knowledge and this can break down formal barriers.
Increased confidence and self-esteem	Engagement in game-based learning can help students to develop confidence generally, and with ICTs in particular, and improve their self-esteem more widely.
Increased teacher motivation	Teachers have become enthusiastic and full of ideas about how to creatively design learning activities around games.
Interdisciplinary learning	Game-based learning has the potential for work which allows for integrated and connected curricular activities, which span the breadth of the curriculum.

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Benefit	Description
Levelling	Students who are not usually seen as leaders or achievers can find new roles and positive affirmation, particularly if they are skilled games players and can contribute this to the group.
Literacy and numeracy	Game-based learning can improve numeracy skills and literacy skills – pupils particularly like reading on the screen compared with texts and games -based learning environments help students generate content for their writing.
Planning, taking responsibility and independent learning	Carrying out games related projects enables students to have the opportunity to plan their own work and take responsibility.
Preparation for the future	Game-based learning can help prepare students by giving them confidence with ICTs, and more specifically, prepare them for education and work particularly in areas of Scotland where game design acts as a major employer.
Problem-solving and trial and error	Game-based learning can help students to understand how to identify and solve issues and problems. Also it helps students to understand that sometimes you have to try out different things before you can find a solution.

Benefit	Description
Pupil-teacher roles	Not only do game-based learning activities allow students to drive their own learning but this also increases teachers' confidence to facilitate and support their students - building on students' own skills and knowledge of games - rather than being more didactic.
Resilience	Game-based activities can develop resilience in students as they negotiate their failures within games and try again. They appear to transfer this resilience to other activities.

Table 2 Taxonomy of educational benefits of gaming drawn from the data

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It is clear from the data that game-based learning presents an opportunity to engage students in activities, which can enhance their learning. Like any successful pedagogy, outcomes need to be well planned and classrooms carefully organised to enable all students to engage in learning. What is notable about using games for learning is the potential they have for allowing many children to bring their existing interests, skills and knowledge into the classroom and then use games as a hook or stimulus to build the activities for learning around them. In many ways these findings reflect those of earlier media education programmes, which sought to capitalise on children's own interest in television and film and build activities around them.

What is not clear from the data is how far the aims of media education which included helping children to understand narrative, representation and audience are migrating to game-based learning in schools. What comes across more strongly in the data provided is that students value the opportunity to play console games and teachers are using this enthusiasm as a motivator for teaching and learning.

Nevertheless, what is also clear from the data is that school leaders and teachers have to negotiate particular barriers in order to bring and sustain game-based learning approaches in classrooms. Often, overcoming initial barriers can actually enable opportunities in the longer term. For instance, many of the school leaders and teachers said that they had worked alongside parents by bringing them into schools or sending letters home in order to communicate the potential benefits of game-based learning to them. Parents had concerns that children were already spending too much time playing computer games at home and were anxious about more time being spent playing games in school. Even so, teachers were able to communicate with parents what the learning outcomes of game-

based learning could be and then parents became convinced when they saw how motivated their children were and the kinds of activities which were being built around games. Therefore, in these ways, game-based learning increased the communication between parents and teachers and school leaders and possibly increased parental engagement in children's learning as parents understood and could talk more to their children about what they were doing in school.

It is also fair to say that some teachers described their initial reservations about bringing game-based learning approaches to their teaching and learning. This can be one of the challenges for school leaders who want to move this approach forward and yet find that teachers are anxious and concerned. School leaders themselves admitted that introducing game-based learning had felt like professional risk-taking and some had acknowledged beforehand that it might fail. Some said they had closely monitored progress and would have immediately stopped it if they thought it was not a useful learning experience for the students. Likewise teachers said that they felt some fear in trying something new and particularly with introducing consoles and games that they were not already familiar with. They had to face feeling out of their depths and they worried that children would be distracted by games rather than learning from them. Having tried using games in classrooms however, most were now convinced of their efficacy for learning. Game-based learning appeared to increase their own motivation as teachers because children had responded so well to the activities and been very supportive to teachers with managing equipment and games. This had improved relationships and meant that some teachers now felt they were more facilitators than instructors who stood at the front of the class telling the children what to do. Even so, teachers were wary of using games too much as the games and activities could become stale.

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Teachers were also careful to choose games where they could define clear learning outcomes and some noted the difficulty of identifying games that could help with particular subjects such as, for example given, for learning chemistry. Others expressed concern that compared with game-based learning other aspects of classroom practice could seem dull to children. Overall, many teachers thought that what was crucial to game-based learning was that teachers themselves knew how to use games well for learning and could mediate them effectively.

Teachers and school leaders also mentioned resourcing game-based learning as a potential challenge. It was noted that funding the purchase of hardware could be particularly difficult and that often this difficulty was managed through borrowing consoles (and games), waiting until games prices came down; and sometimes even through teachers and children bringing their own games consoles into schools.

Many of the school leaders and teachers spoke positively about Curriculum for Excellence which they saw as an opportunity to try out new things such as game-based learning. In this way, approaches such as game-based learning were seen to provide a rich learning environment which could help meet the aims of Curriculum for Excellence and embody the principles of this. Alongside this, the introduction of Assessment is for Learning was seen to complement the curriculum. Some teachers and school leaders remained anxious about assessment, particularly at secondary level. Others felt that game-based learning sat very well with the new assessment regime albeit that some uncertainty was present as the criterion for Assessment is for Learning are still being formulated. The main point emphasised by most teachers was that the use of games in classrooms was to use them as a tool and that as long as clear outcomes were planned, there was no reason for activities not to meet the usual kinds of assessment criteria.

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Recommendations for the further development of educational gaming strategies and policies in the UK (aimed at policy and school leadership audiences)

These recommendations have been developed through careful consideration of the findings from all phases of the project.

Policy

- Given the evidence provided in this report, policymakers should encourage and support school leaders and teachers to introduce well planned game-based learning initiatives into classrooms.
- Policymakers should continue to ensure that enough flexibility is available within the curriculum and assessment regime to ensure that game-based learning can be accommodated. In particular, the curriculum and assessment at secondary level should be reviewed to see how game-based learning could be more effectively fitted in.
- Policymakers should ensure that school leaders and teachers are reassured that games based learning approaches fit with the aims of Curriculum for Excellence.
- Policymakers should continue and perhaps even increase the support given to schools in order to encourage game-based learning approaches. This includes the following elements which school leaders and teachers said that they found useful:
 - Training and showcase events;
 - Continuation of the LTS Consolarium, Glow, LTS game-based learning webpages;
 - Being able to borrow or gain support with buying resources;
 - Coordinated procurement processes which enable schools to buy resources more cheaply.

School leaders

- Given the evidence in this report, school leaders should encourage and support classroom teachers to introduce well planned game-based learning initiatives into classrooms.
- School leaders should acknowledge that game-based learning approaches present a new challenge for many teachers and they need to be well supported. In particular, teachers in this study said that they were helped by:
 - Support with reorganising classrooms for game-based learning;
 - Time and space to plan and develop learning outcomes and activities and to monitor the effectiveness of these closely;
 - Time and space to familiarise themselves with equipment and games;
 - Support from school leaders and colleagues both at local and national level and opportunities to network;
 - Access to support from LTS and local authority staff, GLOW, the LTS Consolarium, Teachers TV;
 - Help with borrowing or buying resources.
- School leaders should aim to convince parents of the potential educational benefits of game-based learning. School leaders and teachers in this study said that the following helped:
 - Explanatory letters to parents at the outset;
 - Open events that parents could be invited to in order to see how game-based learning approaches were carried out.

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Curriculum for Excellence (CfE) – the new curriculum in Scotland (www.ltscotland.org.uk/curriculumforexcellence/curriculumoverview/index.asp).

Chartered teacher – awarded by the General Teaching Council of Scotland to experienced teachers who have demonstrated a high level of expertise in the classroom.

Consolarium – the Scottish centre for game-based learning, run by Learning and Teaching Scotland (www.ltscotland.org.uk/usingglowandict/gamesbasedlearning/consolarium.asp).

Determined to Succeed – the Scottish Government’s strategy for enterprise in education (www.ltscotland.org.uk/enterpriseineducation/index.asp).

GBL – Game-based learning.

Glow – Scotland’s national intranet for education (www.ltscotland.org.uk/glowscotland/about/index.asp).

Glow Meet – live video conference via Glow.

Glow Chat – live messaging via Glow.

HMIe – Her Majesty’s Inspectorate for Education, responsible for inspecting and reporting on the quality of education in Scotland’s schools.

ICT – information and communications technology.

LTS – Learning and Teaching Scotland.

Local authority – the overseeing organisation for specific schools in a given region.

MIICE – The MIICE Project, which seeks to identify and promote good uses of ICT across Scotland (www.miice.org.uk).

School Improvement Plan (SIP) – a strategic plan which each school draws up and reviews annually, to guide their work for a period of usually three to five years.

Scottish Learning Festival (SLF) – annual two-day exhibition of the latest developments in education, from Scotland and around the world (www.ltscotland.org.uk/slf/aboutslf/index.asp).

TEEM – an organisation that evaluates educational software.

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Appendix 1 - Description of schools included in the project

Primary schools

School Local Authority	# of students	Demographic	Month/year console games introduced into the classroom	Cooking Mama	Dr. Kawashima's Brain Training	EyePet	Endless Ocean	FIFA World Cup	Gardening Mama	Guitar Hero	Just Dance!	Korinpa	Little Big Planet	Mario & Sonic at the Winter Olympics	Mario Kart	Nintendogs	Professor Layton	Ruthless Romans	Samba de Amigo	Wii Music	Wii Sports	Wild Earth African Safari
Balmedie Primary, Aberdeenshire		Suburban			X	P2	X			X		X					X	X	X		X	X
Cathkin Nursery, South Lanarkshire	120	Urban	Jan 2010			N																
Cowie Primary, Stirling	145	Rural	Aug 2009		P7		P6			P6						P2		P4				
Cumbernauld Primary, North Lanarkshire	530	Suburban	April 2010				P5								P6-7							
Dalry Primary, North Ayrshire	380	Urban	June 2010												X							
Elrick Primary, Aberdeenshire	356	Suburban	2007		P4-5				P3-4	P7	P7	P4				P1						
Gavinburn Primary, West Dunbartonshire	270	Urban	Feb 2009			P1-2				P7				P3-4	P5							
Hallside Primary, South Lanarkshire					P7					P7									P7			

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School Local Authority	# of students	Demographic	Month/year console games introduced into the classroom	Cooking Mama	Dr. Kawashima's Brain Training	EyePet	Endless Ocean	FIFA World Cup	Gardening Mama	Guitar Hero	Just Dance!	Korinpa	Little Big Planet	Mario & Sonic at the Winter Olympics	Mario Kart	Nintendogs	Professor Layton	Ruthless Romans	Samba de Amigo	Wii Music	Wii Sports	Wild Earth African Safari
Lairdsland Primary, East Dunbartonshire	266	Suburban	Aug 2007	P2-3	P6		P4-5			P6-7						P2			P6-7		P7	
Longhough Primary, Dundee City	296	Urban	Feb 2010			N	P3	P7	P1				P3-4									
Meldrum Primary, Aberdeenshire	306	Rural	May 2007	P4			P6			P7	P6-7	P5			X	P2			P7	P1-3		P4-5

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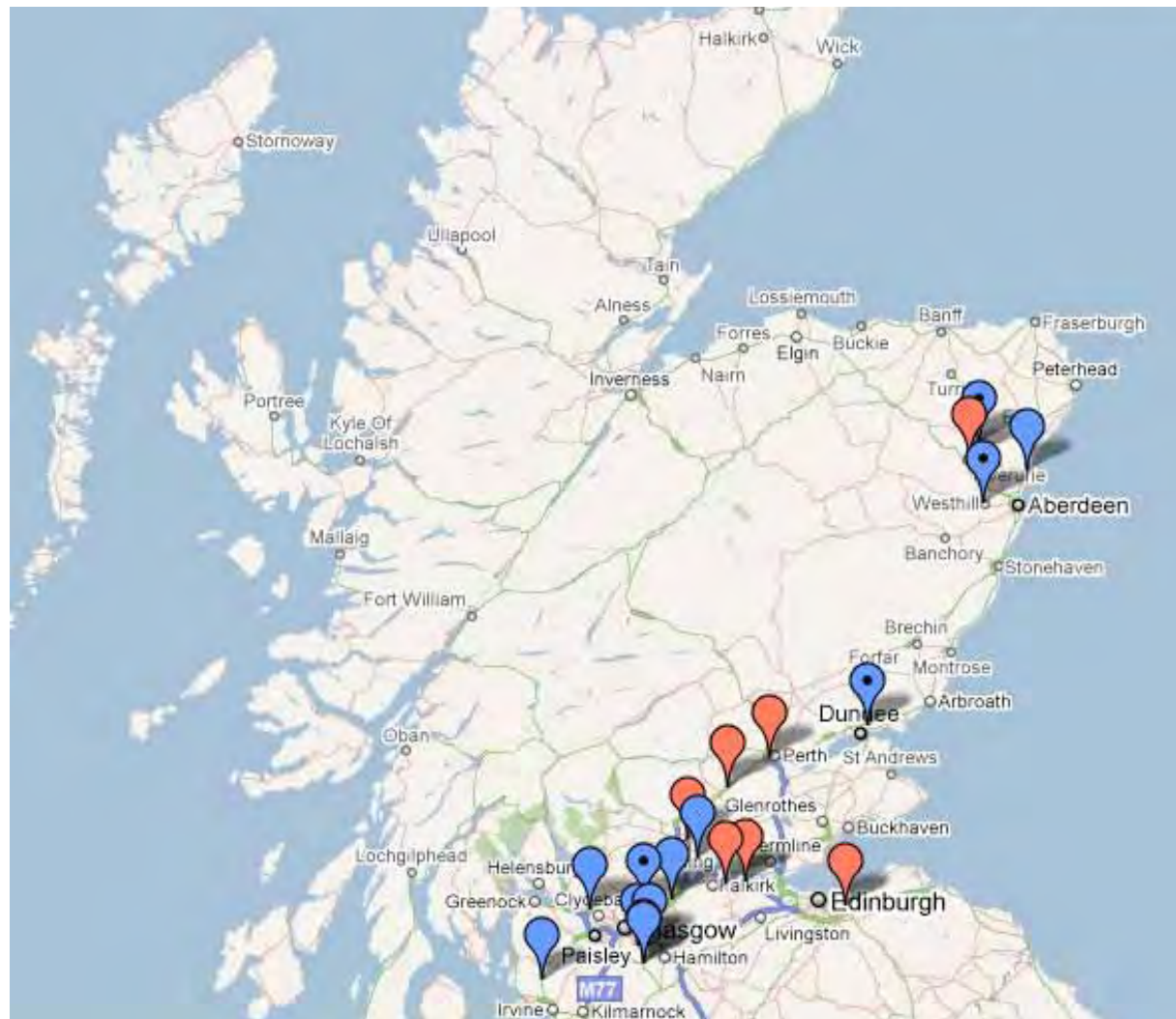
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Map of schools

Secondary schools as red markers, primary as blue.



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Appendix 2

Genre	Examples	Brief description
Action adventure	Tomb Raider, Finding Nemo, Shrek	Having to control a character who has to solve puzzles or tasks in order to complete a pre-defined mission.
Adventure	Monkey Island, Broken Sword	Being assigned roles and then completing a pre-defined mission based on puzzle-solving.
Creative games	LittleBigPlanet	These are between an adventure/platform game and a sandbox for making things.
MMOG (massively multiplayer online games)	World of Warcraft	Interacting with lots of people from all over the world playing the same game at the same time via the internet – often working together to meet shared goals.
Platforming games	Super Mario	The goal is to race to the finish passing through various levels and often jumping from platform to platform avoiding enemies and collecting points to gain skills or enter other areas.
Casual games	Tetris, Zoo Keeper, Cbeebies online games, Miniclip	Intuitive, accessible and easy to play, usually available on handheld consoles or PC via the Internet often involving puzzles and quizzes or Wii games.
Edutainment (Educational games)	Global Conflict: Palestine, Zoombinis	Games with the primary intention of learning.
Role playing games	Final Fantasy	Involving turn-based combat, strategy, and worlds to explore, often fantasy
Rhythm/action games	Guitar Hero, Singstar, Dancemat	Requiring dancing, singing or playing music rhythmically according to instructions with the challenge of being awarded a score.
First person shooter, shoot 'em up and Fighting games	Street Fighter, Grand Theft Auto	Fighting or shooting objects and other game characters, often having to memorise button combinations and requiring fast reactions.

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Genre	Examples	Brief description
God games	The Sims, Black & White	Where the player controls the environment in addition to characters.
Simulations	Microsoft Flight Simulator	Simulations of real activities.
Racing games	Burnout, Gran Turismo	Having to act as the driver and race against others or complete driving courses within a set time – the courses can be realistic or fantastical.
Sports	Championship Manager or Tiger Woods Golf.	Participating in the sport or acting as the manager in a situation mimicking real life competitive activities.
Active technology/ fitness games	Wii Sports, and Wii Fit	Physically taking part in the exercise/activity.
Strategy	Age of Empires, Command & Conquer	Having to plan next move to beat the opponent, often requiring quick thinking
Self improvement games	Brain Training DS	Activities to improve mental, and sometimes physical outlook.
Serious games	Operation Climate Control	Ones that have a primary focus of achieving a learning outcome rather than being played purely for pleasure, it would include all 'edutainment' games.

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Literature Reviews and Research Reports

Written by leading academics, these publications provide comprehensive surveys of research and practice in a range of different fields.

Handbooks

Drawing on Futurelab's in-house R&D programme as well as projects from around the world, these handbooks offer practical advice and guidance to support the design and development of 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.

We encourage the use and circulation of the text content of these publications, which are available to download from the Futurelab website – www.futurelab.org.uk/resources. For full details of our open access policy, go to www.futurelab.org.uk/policies.

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About Futurelab

Futurelab is an independent not-for-profit organisation that is dedicated to transforming teaching and learning, making it more relevant and engaging to 21st century learners through the use of innovative practice and technology.

We have a long track record of researching and demonstrating innovative uses of technology and aim to support systemic change in education – and we are uniquely placed to bring together those with an interest in improving education from the policy, industry, research and practice communities to do this. Futurelab cannot do this work on its own. We rely on funding and partners from across the education community – policy, practice, local government, research and industry - to realise the full potential of our ideas, and so continue to create systemic change in education to benefit all learners.

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Key to Themes

Futurelab understands that you may have specific areas of interest and so, in order to help you to determine the relevance of each project or publication to you, we have developed a series of themes (illustrated by icons). These themes are not intended to cover every aspect of innovation and education and, as such, you should not base your decision on whether or not to read this publication on the themes alone. The themes that relate to this publication appear on the front cover, overleaf, but a key to all of the current themes that we are using can be found below:



Digital Inclusion – How the design and use of digital technologies can promote educational equality



Teachers and Innovations – Innovative practices and resources that enhance learning and teaching



Learning Spaces – Creating transformed physical and virtual environments



Mobile Learning – Learning on the move, with or without handheld technology



Learner Voice – Listening and acting upon the voices of learners



Games and Learning – Using games for learning, with or without gaming technology



Informal Learning – Learning that occurs when, how and where the learner chooses, supported by digital technologies



Learning in Families – Children, parents and the extended family learning with and from one another

www.futurelab.org.uk



Futurelab

1 Canons Road
Harbourside
Bristol BS1 5UH
United Kingdom

tel: +44 (0)117 915 8200

fax: +44 (0)117 915 8201

email: info@futurelab.org.uk

blog: flux.futurelab.org.uk

twitter: @futurelabedu

www.futurelab.org.uk

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