The Use of Wireless Devices to Support Learning in Special Needs Science Lessons.

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Rationale

It is generally agreed that the more actively involved a pupil is in their learning, the more likely they are to enjoy it and make progress. Unfortunately, some children are limited in their opportunities to participate due to problems with mobility, co-ordination or their ability to process complex information.

The new range of wireless interactive computer-based devices offers a possible solution. The aim of the project was to explore the various devices available, the software that supports them, and the alternative strategies that can be used.

This case study is a summary of the work we did investigating the various wireless platforms and how they could be used to help promote active participation in science learning by pupils with moderate and severe learning difficulties.

Within the case study we looked at:

- Games machines
- Tablets
- Wireless support for PCs

The case study produced some startling results, particularly related to some of the children with autism, and to an individual with particular communication difficulties.

Games Machines

Most of us will be familiar with these three devices:

		
Xbox 360 with Kinect	Nintendo Wii	Playstation 3

The table summarises what we felt were the important aspects of each one:

Manufacturer	Device	Remote sensing system	Comments
Sony	Play Station 3	Move	One or two controllers Tracked accurately by camera High quality graphics
Nintendo	Wii / Wii +	Wii remote & nunchuck Wii motion + Wii fit balance board	Relatively poor graphics. Accessories – such as steering wheels – can make using remotes easier.
Microsoft	Xbox 360	Kinect	No remote needed – responds to gestures and spoken commands.

These are the so called "7th generation" devices. As this is being written, the 8th generation devices are just starting to come out. Below is a summary of what is known about them:

Manufacturer	Device	Remote sensing system	Comments
Sony	PlayStation 4	DualShock4 controller with inbuilt touchpad and Light Bar for Move-style motion sensing (PlayStation Camera required, sold separately)	Available now.
Nintendo	Wii U	Tablet device that allows interaction with main screen/uninterrupted play. Wii Remotes.	Available now.
Microsoft	Xbox One	Kinect 2	Available now.

In our work we focused on the Wii and Xbox.

Nintendo Wii and Mario Karts Racing


Using Wii to support work on motion.

Mario Karts Wii is a very popular game that allows up to 4 players to race against each other in different vehicles and over several courses.

When choosing the vehicle, players are given a summary of the relative strengths of each one for parameters such as speed, acceleration, weight and “off road”.

We used this to support a lesson on acceleration. Using the Wii as a starting point, we discussed what the various parameters meant and how they would affect the outcome of the race. We also took the opportunity to reinforce investigation skills by timing the races and comparing the results.

We found that, with a relatively able group, it worked very well. Pupils were very keen to join in with both the discussions and the game itself.

However, we identified several issues when using it with other groups:

- Problems with knowing, and remembering, what the different buttons on the handset did.
- With the split screen, there was confusion over which vehicle they were.
- Difficulties with the steering wheel, e.g. moving through too large an angle.

With some of the pupils, whilst they clearly enjoyed the experience, there was little evidence of learning.

Other Wii Activities

- Wii fit

  We used the jogging activity with some pupils who had difficulty with the handsets/steering wheel. We also used the balance board and balancing activities with some pupils. This was in support of some work we were doing on stability and moments.

- Wii Sports and Wii Sports Resort

  The pupils had a lot of fun with the kendo games in particular. Many of the activities on these games and the Wii Fit could be used within a topic on health and fitness.

- Big Brain Academy

  We found the number sorting activities (you have to pop balloons with numbers on, in the correct order) to be particularly motivating. We used this to support work in Maths.

- Let’s Dance Wii

  More fun for pupils. We actually used it to support PE lessons. (Although in our experience, it could be used in relation to work on heart and breathing rate!)

Microsoft Xbox 360 and Kinect.

We found that the Kinect sensor overcame many of the difficulties associated with handset game controllers outlined above.

The main advantages we found were:

- No hand held remote needed – the player's movements control the actions of an avatar on the screen.
- The screen is not split – the two players stand next to each other and both appear on the screen.
- The player can be recognised automatically and the appearance of the avatar can be adjusted.

Using Kinect Adventures, and in particular the River Rapids activity, we found that pupils who had poor fine motor skills could now interact with the game. This allowed us to investigate cause and effect, and introduce some of the ideas associated with motion. It was clear that, for the first time, some pupils were able to see how their actions directly affected the game they were playing. This had a large impact on some pupils' motivation and involvement in lessons.

Autism and avatars

Perhaps the most significant outcome of this work, however, came from our experiences working with some of the children with autism. We found that certain children who rarely interacted with others in the group, and were reluctant to take part in shared activities, were able and willing to collaborate with fellow pupils using their on-screen avatar.

The significance of this should not be underestimated and it is worthy of much further study.

Other Kinect Activities

- Kinect Zumba Fitness

  We used this as an alternative to the Wii Let's Dance described above.

- Sesame Street

  The players are scanned by the Kinect camera, and are "placed" within an episode of Sesame Street. In this case they see themselves rather than an avatar.

- Kinect Fun Labs

  This is a gateway to an increasing array of activities designed to make the most of the Kinect control system. Activities such as Googly Eyes and Kinect Me allow the player to scan, adjust and manoeuvre images on the screen. Air Band is an activity which allows up to three players to "play" drums/guitar/keyboard in a virtual band whilst the game produces the music. We could see how this could feed into a lesson on sound.
  connect to fun lab website to get a feel for what is available.

- Body and Brain Connection

  This is a Big Brain Academy type activity.

Tablets

There are very many tablet devices available. The table below is taken from the PCWorld website. A quick search would reveal many other comparison websites.

	iPad (3rd Gen)	Transformer Prime	Transformer Pad Infinity	Iconia Tab A700	Galaxy Note 10.1	Galaxy Tab 10.1	Excite 10 LE	Droid Xyboard
Manufacturer	Apple	Asus	Asus	Acer	Samsung	Samsung	Toshiba	Motorola
Price	From $499	$499 (32GB) $599 (64GB)	Unannounced	Unannounced	Unannounced	From $400 (Wi-Fi)	From $530	From $530
Availability	16 Mar 2012	Shipping	Unannounced	Unannounced	Unannounced	Shipping	Shipping	Shipping
OS	iOS 5.1	Android 3.2 Honeycomb	Android 4.0 Ice Cream Sandwich	Android 4.0 Ice Cream Sandwich	Android 4.0 Ice Cream Sandwich	Android 3.2 Honeycomb	Android 3.2 Honeycomb	Android 3.2 Honeycomb
Cellular Connectivity	3G/4G LTE	No	3G/4G LTE	HSDPA	HSPA+/EDGE-GPRS	HSPA+/EDGE-GPRS	No	3G/4G LTE
Dimensions	9.5 x 7.31 x 0.37 in	10.35 x 7.12 x 0.33 in	10.35 x 7.11 x 0.33 in	10.24 x 6.85 x 0.39 in	10.1 x 6.9 x 0.35 in	10.1 x 6.9 x 0.34 in	10.1 x 6.93 x 0.3 in	10 x 6.93 x 0.35 in
Weight	1.4 pounds	1.29 pounds	1.29 pounds	1.43 pounds	1.28 pounds	1.24 pounds	1.18 pounds	1.32 pounds
Display Size	9.7 in	10.1 in	10.1 in	10.1 in	10.1 in	10.1 in	10.1 in	10.1 in
Display Resolution	2048 x 1536 px	1280 x 800 px	1920 x 1200 px	1920 x 1200 px	1280 x 800 px	1280 x 800 px	1280 x 800 px	1280 x 800 px
Display Pixel Density	264 PPI	149.45 PPI	224.17 PPI	224.17 PPI	149.45 PPI	149.45 PPI	149.45 PPI	149.45 PPI
Processor	Dual-Core A5X with Quad-Core graphics	1.3 GHz Quad-Core	1.6 GHz Quad-Core	1.3 GHz Quad-Core	1.4 GHz Dual-Core	1 GHz Dual-Core	1.2 GHz Multicore	1.2 GHz Dual-Core
RAM Memory	Unspecified	1GB	1GB	1GB	1GB	1GB	1GB	1GB
Storage	16/32/64 GB	32/64 GB	32/64 GB	16/32/64 GB	16/32/64 GB	16/32/64 GB	16/32 GB	16/32/64 GB
Expandable Storage	No	microSD (up to 32GB)	microSD (up to 32GB)	microSD (up to 32GB)	microSD (up to 32GB)	No	microSD (up to 32GB)	No
Back Camera	5MP	8MP + flash	8MP + flash	5MP + flash	3MP + flash	3MP + flash	5MP + flash	5MP + flash
Front Camera	Yes	1.2MP	2MP	2MP	2MP	2MP	2MP	1.3MP
WiFi	802.11 b/g/n	802.11 b/g/n	802.11 b/g/n	802.11 a/b/g/n	802.11 a/b/g/n	802.11 a/b/g/n	802.11 b/g/n	802.11 a/b/g/n
Bluetooth	Yes	Bluetooth 2.1	Bluetooth 4.0	Bluetooth 3.0	Bluetooth 3.0	Bluetooth 2.1	Bluetooth 2.1	Bluetooth 2.1
GPS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Battery	Unspecified	6930mAh	6757mAh	9800 mAh	7,000mAh	6800mAh	6800 mAh	7,000mAh

At the beginning of the project, we decided to go with the Motorola Xoom. It had many advantages over other tablets available at the time, including the iPad. For example, the screen was larger, and it has front and back cameras and voice recognition. We also felt that, as the Xoom is an Android device, it would be cheaper to buy compatible devices should parents, or the school, wish to.

We found that pupils were very interested in using the tablet and most could quickly learn how to interact with it.

Part of the appeal is easy access to the internet. This allows pupils to view Youtube clips, or other useful websites, individually. This is particularly helpful when pupils are getting one to one support.

The Apps we worked with included:

- Skitch

  This is one of the many free photo editing apps. With Skitch you can annotate a photograph with arrows and text. We used this during a lesson on plant cells. Pupils made a model plant cell using a plastic tub, a food bag, peas, a marble, paste, and a bag of water. We had labels for cell wall, cell membrane etc. Pupils used the labels with their models. We also took a picture of the cell with the labels next to it and pupils used Skitch to draw arrows between the labels and the cell.
- Sound effects / sound touch.

  There are many free sound effect apps available. One example of its use occurred during a “pirate day”. We decided to build a canon which would fire balls at a ship. A string fuse was used to pull back elastic bands. When the fuse was burned through, the elastic bands threw the ball out of a tube. We needed a sound effect to go with it – and used the sound effect app. One pupil lit the fuse, and another used the tablet to make the sound.
- Youth musical instruments

  Another free app that allows pupils to “play” instruments on the screen. There are also several other keyboard apps that could be used to support a lesson on sound, for example.
- Cut the rope

  A popular game that involves some physics – understanding forces and motion helps solve the problem of feeding a little creature biscuits.
- Colour chain reaction

  Players have to create explosions that initiate a chain reaction to explode coloured balls. It takes some judgement to predict the paths of the balls after bouncing off the sides. This is another interesting physics app.
- For science

  Players have to line up humans, cows and cars with the correct alien space ship. It is essentially a sorting exercise.
- Sky Map

  This is a google app that shows an image of the sky, in the direction you hold the tablet. This was used as part of a lesson on day and night. On a cloudy day, we used the tablet to find out where the Sun was, and discuss where it would be later in the day. We have also used it to help find the planet Mercury in the early evening.
- Talking Tom

  An animated cat appears on the screen that listens when you speak. It then repeats your words using a “cat” voice. You can interact with the cat by giving it milk, tickling its tummy or hitting it. We had a pupil who usually chose not to talk in school. The few times she did speak, she was almost inaudibly quiet. We decided to use Talking Tom to encourage her to talk. The speaker threshold meant that she had to talk reasonably loudly to get it to respond. As she gained in confidence with Talking Tom, we used other apps to encourage her to continue to interact.

This list is not meant to be exhaustive. There are very many apps available for use in lessons.

iPad apps

Many schools are using iPads in the classroom. There are many educational apps available. A simple search would reveal a list. For example, try these 10 top science ipad apps.

My feeling is that, at the moment, there are many more iPad apps created specifically for the education market. This may mean that it would be easier to incorporate iPads into the classroom.

The wireless PC.

There are so many extremely useful educational programmes and other resources already on the computer in the classroom, we decided to look at improving accessibility to the humble class PC.

For example, a simple wireless mouse allows pupils with poor mobility to use the interactive whiteboard with the rest of the class. We also have large button switches that allow pupils with poor motor skills to participate in computer activities. It is interesting to note that work is being done that will allow groups of pupils to interact with the PC using a webcam in a similar way to the Kinect.

There are many interesting science games available for PC. Try science games to find out about some of them.

The Future

Many organisations are developing materials for use in the classroom.

These websites give some indication of the work that is being done.

- http://dailyedventures.com/index.php/2012/09/20/shannon/
- http://www.microsoft.com/education/en-us/products/Pages/kinect.aspx
- http://kinectsen.wikispaces.com/
- http://www.special-needs-kids.co.uk/Special-Needs-Software.htm
- http://blog.learningtoday.com/blog/bid/24286/Wii-Therapy-for-Special-Needs-Students

Summary

The project set out to find out if pupil interaction, and therefore learning, in lessons could be improved by incorporating wireless devices in the classroom. The answer is clearly: “yes”.

We found that using game machines that do not require a hand held remote and generate an avatar of the player, such as the Xbox Kinect, allowed some pupils to interact in a way they had not done before. We also found that, with little effort or experience, a tablet can be used to instruct, motivate and captivate the pupils.

This case study is not intended to be a definitive guide to what to use or how to use it. All the specific discussion of software and hardware has a shelf life. We hope that it does make the case that working with wireless devices is worth doing. It opens up a world of interaction that many pupils would not otherwise experience.

We do not believe that wireless devices should replace the important “real” experiences pupils should have. Rather they should be used where the pupils’ experiences can be enhanced. In our work we have tried to keep in mind three things: have fun, be imaginative and target the learning.

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February 2013