

UNIVERSITY OF
NEWCASTLE UPON TYNE



Creative Use of Technology to Optimise Peripheral Learning



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■ PROJECT AIMS & PROGRESSION FROM YEARS ONE AND TWO

The project combines two of the Camborne, Pool and Redruth Learning Space's (CPRLS) focus areas: 'excellence through creativity' and 'excellence in state of the art technology'. The project aims to investigate if and how ICT (more specifically, the use of *PowerPoint* presentations on plasma screens) can be used to access and utilise a number of different ways of learning (e.g. peripheral/subconscious learning). In terms of the 5 Rs, the project will focus on Resourcefulness and Remembering.

■ RESEARCH FOCUS

It was hoped that the research would demonstrate that *PowerPoint* presentations, in conjunction with the plasma screens, would be an effective, implicit, way for students to learn. It was also hoped that the project would demonstrate how psychological theory can directly be applied to an educational context.

■ DIMENSIONS OF THIS CASE STUDY

The CPRLS is part of the Camborne, Pool and Redruth Excellence Cluster (CPR Success Zone). The CPRLS is an equal partnership of 28 schools, which actively encourages an ethos of collaborative innovation within the Success Zone both within the CPRLS and its outreach programmes.

The sample group for this research consisted of 28 Year 6 and 7 students (i.e. transition years) on this year's Summer Challenge project. (The sample also included three peer tutors and one adult).

■ SUMMARY OF FINDINGS

- A comparison of the morning with the afternoon results showed that the majority of students had improved their scores (by an average of two correct answers).
- The scores increased across 80% of the questions.
- The increase in scores between the morning and afternoon quiz was statistically significant. It was also found that the use of the plasma screens had a large effect size - higher than the average for an educational innovation. This strongly supports the original hypothesis.
- Even though the research was a success and demonstrated the impact of the plasma screens on the students' learning, the sample size was relatively small. The experiment would need to be replicated with a much larger sample in order to be more confident in the results.

Focus in the 5 Rs for Lifelong Learning:

Resilience	<input type="radio"/>
Remembering	<input checked="" type="checkbox"/>
Resourcefulness	<input checked="" type="checkbox"/>
Reflectiveness	<input type="radio"/>
Readiness	<input type="radio"/>

YEARS ONE & TWO RESEARCH

Summary of Year One and Two findings

Although involved with the Learning to Learn (L2L) project since the beginning of Phase 3, this has been in a co-ordination capacity, forming a link between the Newcastle University research team, the Campaign for Learning and the schools in Cornwall involved with the project. A decision was made to get involved with the research element at this stage, based on a number of factors:

- The Camborne, Pool and Redruth Learning Space (CPRLS) aims to be an innovative and experimental educational environment. We actively encourage staff and students to think outside of the box, stretch comfort zones and take risks (within a supportive environment). We constantly reflect on what we do and adjust how we work, based on our experiences and we are very flexible in our approach to working with people of all ages. In addition, the CPRLS staff model this way of working - for example, members of the team who do not have formal teaching qualifications are encouraged to take on a lead learner role. Overall, the ethos makes the CPRLS an ideal place in which to do research.
- CPRLS is an equal partnership of 28 schools collaborating in the Success Zone. It also represents the central 'hub' for the Gifted and Talented (G&T) strand of the Excellence Cluster, as well as for creativity and IT elements. After an initial 'settling' period, we thought it would be exciting and interesting to formalise our experimentation in these areas through taking part in the L2L project. We need explicitly to evaluate the impact of our work and the effectiveness of the hub as a whole. This research will

help us to start working towards this goal in a much more cohesive way.

- It was felt that the CPRLS would provide an interesting contrast to the more traditional school/classroom based environments.
- We feel that the 5Rs are already embedded in the CPRLS framework. Although not necessarily explicitly mentioned, most of our projects aim to develop these qualities in learners who visit us. Many of our programmes are based on our 'Brain Wave Challenge framework'. The main elements of this are included in Appendix 1.

Learning through research

The project is based on research being carried out in a secondary school in North Cornwall. In this school, the teacher was using two projection screens in his lessons. One was being used in the standard way, showing information relevant to the current lesson. The other was displaying a *PowerPoint* presentation showing content-specific information, to help introduce forthcoming topics and aid exam revision. An important feature of this second *PowerPoint* was that it was constantly changing and was shown slightly to the side of the front of the room.



The Dome – a space within the Learning Zone

The research had shown that following exposure to this set-up, students' exam results had increased dramatically. This was seen as a demonstration of the use of

the secondary *PowerPoint* having a positive impact on the students' learning. Another teacher (from a secondary school in North Cornwall) has also experimented with the use of *PowerPoint* during lessons. Again, these presentations showed key information and facts, relevant to the history lesson. However, the distinguishing feature of these *PowerPoints* was that the slides changed very quickly - it was only possible to detect a small amount of information with each viewing. The complete set of information built up as the *PowerPoint* was viewed repeatedly. Again, this creative use of *PowerPoint* resulted in an increase in student motivation and information retention.

These case studies inspired us to explore how we use the plasma screens in the CPRLS. Furthermore, they sparked a discussion about subconscious learning and how different, perhaps less conventional, modes of learning could be used.

The plasma screens, showing *PowerPoint* presentations, are used on a daily basis and are an important part of CPRLS programmes. In the past, we have experimented with the use of plasmas and projection screens - for example, using more than one projection screen to display different themes, words and images to create a strong impact, e.g. three projection screens were used during the CPRLS Open Day.

The research project provided the opportunity to explore, in depth, one particular element of the CPRLS learning environment i.e. the plasma screens. It will provide the impetus to develop the use of the screens, encouraging us to think more carefully about what we include in the *PowerPoint* presentations and how we can maximise their use. It is hoped that the project will provide the necessary evidence for their importance within the learning context offered at the CPRLS.

Apart from allowing us to look at the use of the plasma screens in a more organised way, the research will enable the CPRLS team to develop new skills. For example, a general area for future development at the CPRLS is to evaluate our programmes to a greater extent and provide concrete, supportive evidence that we provide an effective learning environment. To help us achieve this, we have discussed purchasing an electronic voting system. This experiment will provide an ideal opportunity to trial the system and explore its potential and suitability.

With all of this in mind, this research project represents the convergence of a number of factors, including previous experience, theory and existing good practice, enabling the plasmas to be investigated in a systematic way.

Moving forward

The 5Rs are fundamental to all CPRLS programmes/activities. The elements listed above are also central to the Accelerated Learning Cycle, inspired by Alistair Smith which may be a product of our involvement with the University of the First Age (UFA). Hopefully, involvement with the L2L research project will help to consolidate these various frameworks, especially as there is already evidence of a huge overlap. It is also hoped that our involvement will provide evidence of the effectiveness of these frameworks, within our unique context.

CONTEXT

Centre background

The Camborne Pool and Redruth Learning Space (CPRLS) is situated in Camborne, West Cornwall. The CPRLS is part of the CPR Excellence Cluster (Camborne, Pool and Redruth Success Zone (CPRSZ), formerly Cornwall's only Education Action Zone), which could be seen as an

indication of the level of deprivation within the local area. The schools involved with the CPRSZ are in an area where academic aspiration and attainment are traditionally very low.

The CPRSZ consists of 28 schools in total (21 primary schools, three infant, three secondary and one special school). After transitioning from an EAZ to an Excellence Cluster in January 2005, twelve of the schools (including the three secondary schools) have become 'core' schools, with the remaining being associates. The CPRLS, as an equal partnership, actively encourages all schools (catering for all age groups) within the CPRSZ to be involved with projects, both at the CPRLS and in outreach programmes.



The CPR Learning Space

The CPRSZ bid for, and was awarded, the funding to build a Classroom of the Future as it was in a deprived area with challenging educational circumstances. The CPRLS aims to raise the expectations of learners and leaders of learning, as well as to promote a hub for the sharing of good practice.

Aimed at challenging people's thinking about what classrooms and learning could look like in the future, CPRLS projects integrate innovative learning and teaching practices with cutting edge technology within an environmentally and energy sustainable building. For example, the building has ground source heating, solar heated water, PV electricity, and a grey

water system. It is also made of sustainable materials (recycled paper and sheep's wool is used for insulation, the timber frame is taken from sustainable woodlands and solvent free paints are used throughout).

The Space

The CPRLS is an innovative, flexible building with three generous learning spaces, called the Pod, Dome and X-Change. In addition, there are two seminar rooms. All of the rooms feature the latest Information Technology (IT) equipment and flexible furniture options. There is a range of furniture in all of the rooms which can be configured to suit the activity (e.g. beanbags, stackable stools, floor mats and footstools), in addition to more traditional foldable, round tables and chairs. The students and visitors are also encouraged to move the furniture and use it in whichever way they feel most comfortable.

This flexible way of working is supported by the wireless network throughout the Centre and the use of tablet PCs, rather than fixed work stations. The Pod and Dome are circular in shape and have no windows, which gives the strong advantage of being able to 'suspend reality' and transform them into a variety of settings. For example, for a project called 'Wild Space', the Dome is transformed into the rainforest, with relevant images on the plasma screens around the room, atmospheric dimmed lighting and jungle sounds played through the surround-sound system. The Pod and Dome are also linked via an intercom system and groups can see each other on the plasma screens, featuring images taken by the pan, zoom and tilt cameras in both rooms.

The X-Change is often used as a meeting/briefing area. There is a large projection space across the front wall. There is also a projection screen towards the back of the room, this enables us to organise seating to suit the needs of the

activity. The system enables us to project up to eight different images at one time. The X-Change has video conferencing facilities, as do the two seminar rooms.

The Educational Features

The key strands for development within the Excellence Cluster are:

- excellence through creativity;
- Gifted and Talented provision and support;
- learning support through a multi agency approach (i.e. CPR SMART); and
- development of learning support units with learning mentors.

The CPRLS supports these strands, with a particular focus on creativity and G&T provision.

Excellence through creativity

At the CPRLS, our learning programmes are not bolt-on, one-off experiences. We are very much guided by the needs and ideas of our schools and try, wherever possible, to integrate the projects here with activities happening back in the school classroom.

We have planned and delivered 17 different programmes along with colleagues from school teams. This collaboration gives school staff an

opportunity to explore and experience firsthand alternative, effective learning methodologies that can be translated in numerous ways back in their own classroom setting or for the school as a whole. To help enable this to happen, all of our programmes are planned with our Brain Wave (personalised learning challenge) framework in mind - a format which was originally designed to transfer a more experimental and creative way of learning into mainstream education.

We aim to make learning cross curricular, contextualised and challenge based; giving students opportunity to demonstrate their new learning, both during the process and by presenting their achievements to an audience. The advantage of the CPRLS is that it offers a blank, neutral and spacious area for a wide range of activities. This enables us to make our programmes much more kinaesthetic and multi-sensory than maybe they could be within the less flexible, traditional classroom space.

Learners of all ages are given the freedom to direct their own learning (both what they want to learn and how they want to learn it). We have found that if students see the point of what they are learning, understand what they are doing, get to make decisions about their learning and experience success, they become more self motivated, confident, independent learners.



The X-Change- taken from the same angle, demonstrating some of the ways in which it is used

YEAR THREE PROJECT 2005/2006

CPRLS projects are based on what we already know about learning and teaching research, supported by our wide experience of programmes within the CPRSZ; however, we want to push beyond this. With this in mind we try to offer experimental learning and teaching for all (staff and students). For example, staff visiting with their class get the opportunity to see how things could be different, as well as having the chance to 'take a step back' and observe how the students in the class are working (something which they often comment that they do not normally get the opportunity to do).

We also actively encourage adults other than teachers to take responsibility for planning and leading projects. We aim to provide a safe and supportive environment for school staff to experiment outside of their comfort zones. Last year we experimented by handing over the responsibility for planning to students (e.g. a group of peer tutors helped to plan our University of the First Age (UFA) and G&T Summer Challenges). These were hugely successful and further developed the role of the peer tutor - many of whom had worked with us before on projects.

Gifted and Talented Provision

The CPRLS has been the base for the G&T strand of the Excellence Cluster since January 2005. As well as providing support for G&T co-ordinators from all CPRSZ schools, we also run a number of programmes for G&T students (e.g. IT/Science/Maths, Master-Classes, Summer Challenges, 'My Time Capsule' Days and Animation Challenges). In addition to the more traditional G&T view, we believe that everyone has the ability to be gifted and talented in some way, given the right experiences and support. We also believe that potential is not fixed. It is about a person's knowledge, skills, attitudes, self image and abilities, as well as the opportunities they are given to practice, explore, develop and demonstrate

these. Our programmes are designed with this philosophy in mind.

In addition to creativity and G&T provision, the CPRLS aims for excellence in state of the art technology, environmental responsibility and raising the levels of aspiration and achievement of the whole community.

The CPRLS aims to challenge ideas about what classrooms and learning could look like and we would like this to reflect the good learning practice researched as part of the L2L project.

Personnel involved in the project

As with all our projects, all of the CPRLS team (six) will be involved with the research. The member of staff who will be leading the research has worked with the CPR Success Zone for three years and has been based in the CPRLS since it opened in 2004. She has a background in psychology and has achieved a BSc Psychology and Communication degree and MSc Cognitive Neuropsychology. Research carried out for these degrees, respectively, focused on maths development in primary school children and memory development in children.

CPRLS programmes are run by a team of open minded, positive and enthusiastic facilitators, who understand how people learn most effectively. Lead learners are opportunistic about the learning that can take place and try to embed new learning in a context to which the students can relate. Our approach to learners is one of 'we're all in this together', role-modelling our learning principles; a sense of humour is also an advantage!

We work in a highly stimulating environment, which includes a number of plasma screens and we want to make best use of these in the future. Action research will inform us about how best to do this.

PROJECT OBJECTIVES

Developing this rationale

Given the ethos and physical layout (mentioned above), the CPRLS is an ideal place in which to conduct action research. This project combines two of our focus areas: 'excellence through creativity' and 'excellence in state of the art technology' and is based on observations by staff (both by the CPRLS team and visiting staff).

During the majority of our school projects, we have a series of sophisticated *PowerPoint* presentations showing on the plasma screens in our three 'classroom' spaces (five plasma screens in the Pod, one plasma screen and six TFT screens in the Dome and two plasma screens in the X-Change). These presentations consist of visual images, animations, words, phrases, questions, facts etc., relevant to the topic of the project/theme of the room. Alternatively, we display *PowerPoints* of the visiting learners (or previous visitors from their school), to create a sense of belonging. Although we do not draw attention to these screens and the information on them, they play a very important role during the activity. For example, pupils often pick up on the information and it gets included in their brainstorms at the end of the day about what they have learnt.



The range of furniture being used in the Pod

Objectives

We thought that it would be interesting to investigate how we could utilise the plasmas as a form of information communication in a more efficient way and develop it as a means of optimising the pupils' learning experience when they visit the CPRLS.

With all of this in mind, the 5Rs on which this research will focus are:

1) Resourcefulness

- Attitudes and Attributes - learning creatively in different ways:
 - Skills - Find and use information;
 - Make the most of the preferred learning style and environment.
- Knowledge - To seek out and use information, including through ICT:
 - How humans learn.

2) Remembering

- Attitudes- Maximising own memory
 - Skills - Use different memory approaches:
 - Make connections
- Knowledge- To use different memory approaches
 - To make connections.

It is hoped that the project will show how psychological theory can directly be applied to an educational context. Furthermore, it aims to show how the latest brain and psychology research can inform educational practice, particularly in relation to what we know about how memory works.

Hypothesis

The use of ICT (specifically plasma screens displaying constantly-changing *PowerPoint* presentations) will access and utilise a number of different ways of

learning (e.g. Subconscious memory mode). Hopefully this will demonstrate that the *PowerPoint* presentation is an effective, implicit, way for students to learn. If successful, this will increase the amount of information that can be conveyed to students and, in turn, add another level to the existing learning experience/environment.

RESEARCH PROCESS

Teachers' choices

As previously outlined, we decided to look into the impact of the plasma screens on the whole learning experience offered at the CPR Learning Space. It was decided that the research experiment would be conducted during the Summer Challenge project. The project involved 28 Year 6 and 7 students, plus three peer tutors (one Year 9 and two Year 10s) and one visiting adult, making the sample a total of 32. The sample included 20 females and 12 males. We were able to cross reference the sample with the CPRSZ's Gifted and Talented Register - nine of the students were on it, plus two of the peer tutors (one Year 9, one Year 10). Selection criteria for students on the Summer Challenge were left very open. Staff from the participating Zone schools were asked to select 'those who might benefit from involvement with a creative, student led project. The selected students were then asked if they would like to be involved and then applied. As such, the students were willing volunteers. Although this suggests that the students were all motivated and enthusiastic, they were not all necessarily academic or particularly enjoyed school. Using the students on our Summer Challenge as the sample for the research offered a number of advantages. The students were working with us for a whole week, meaning that we had more time and space to allocate to the experiment. It also meant that we could

easily do a follow up questionnaire the day after the experiment.

In order to quantify the impact of the plasma screen on the information learnt by the students it was necessary to determine the students existing knowledge base about the chosen topic, prior to the experimental conditions (i.e. being exposed to the information on the plasma screens). A quiz was designed based on the information contained in the *PowerPoint* presentation. The quiz included 10 multiple choice questions, based on GCSE level Geography and was about 'Coastal Processes' (see Appendix 2 for the complete quiz).

The topic was chosen as it was thought to be relevant to the overall week as the students had already visited a local beach as one of their activities. However, it is important to note that at no point during this visit was the information shared with the students. Some of the questions were deliberately set at a high level (at least four years ahead of their academic year), which required the students to recall specific knowledge and vocabulary if they were to answer them correctly (i.e. The information was not something they were likely to have come across in everyday life). Again, this was to help clarify what information they had picked up from the plasmas.

To collect the students' responses to the quiz, we chose to use an electronic CPS (Classroom Performance System) Voting System/Software. This system offered a number of advantages over a less sophisticated recording system such as pen and paper:

- Each student was able to vote anonymously. This meant that the 'group herding effect' was not an issue - a problem we have found previously when doing multiple choice quizzes, with four cards set up around the room (A, B, C, D) and asking the students to

choose the card they think correlates with the correct answer. In the past, we have found that using this method, students tend to go to the card with the most students, or where their friends have gone, rather than thinking for themselves and choosing the one they think is the correct answer.



Students using the CPS Voting Hand Sets

- The electronic system had the capacity for each student to have their own individual, hand held voting panel (a wireless networked, egg shaped device with buttons on it to match each of the four multiple-choice options (A, B, C, D). Each hand-held set was registered with a particular user. The students were able to do this themselves; registering was included as part of the activity - this encouraged the students to take ownership for it and immediately involved them with the activity. Each student used the same hand set for both the morning and afternoon quizzes. This enabled us to track an individual student's performance on the two quizzes - clearly showing how/if they had improved.
- The electronic system also offered a fun way of collecting the information. The students were encouraged to imagine that they were the audience on 'Who wants to be a millionaire?'

During the morning briefing session (something which happened every day of the Summer Challenge), the students were told that the CPRLS also had a challenge of their own to complete that week. The

background to the project was explained to them (e.g., National project etc); however, they were not told the precise details of the experiment. That is, the fact that the necessary information would be on the plasma screens throughout the day was not mentioned. Also, the students were even not made aware that the experiment was looking at the effect of the plasmas screens - they were just told that it was a quiz designed to try to find out what they knew about 'Coastal Processes'. They were also told not to worry if they did not know the answer, but that the important thing was to 'have a go', even if it was just a guess. Students did not know they were going to be re-tested at the end of the day.

The advantage of choosing the Summer Challenge students to be the sample was that we had already built up a relationship with them across the week, their confidence had increased and the atmosphere was relaxed. This meant that where the activity could have been seen as a test and therefore been quite an intimidating experience, hopefully the students felt more comfortable taking part in the quiz and saw it as a fun activity instead. To reinforce this idea, we made sure that everyone was involved. For example, on this day we had an extra adult visiting who was going to be running a performance skills workshop, he was also asked to take part and it was helpful for the students to see that even he admitted to struggling with some of the questions! The peer tutors also took part in the experiment.

The quiz was then conducted using the electronic voting system. Following this, the students continued with the Summer Challenge timetable. On this day, (day four out of five) they were participating in workshops and doing their final preparations for the Show and Tell to an audience of family and friends the following day.

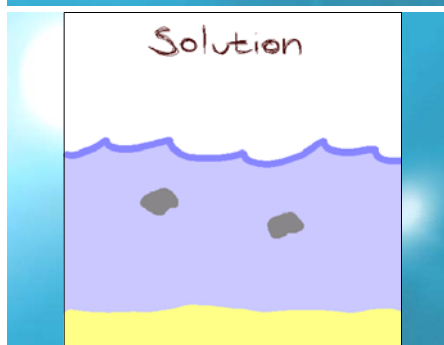
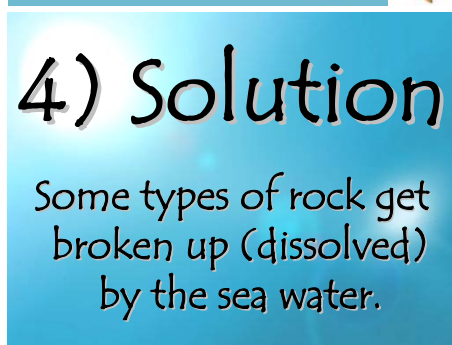
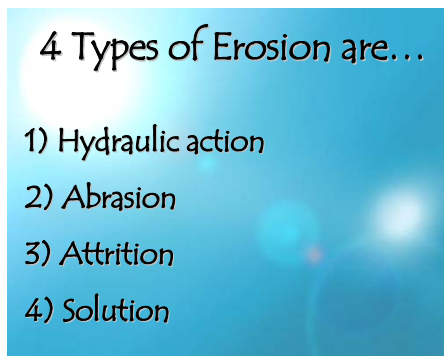
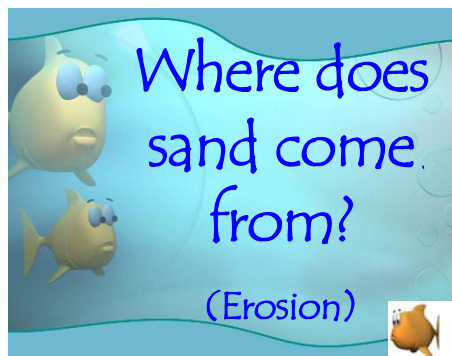
The experimental *PowerPoint* presentation was displayed on a number of the plasma screens in all three of the rooms in which the students were working. It was not put on all of the plasma screens, as we thought this might make it too 'obvious'. Instead it was shown alongside *PowerPoint* slides of photographs of the week's activities so far (something that we had been changing throughout the week), photographs of the environments they visited (beach and woodland) and natural art.

The experimental *PowerPoint* included key words, short descriptions and animations (using 2Simple Animation Software - good, fun activity for the research leader!) of the different coastal processes in action. The *PowerPoints* were designed with the Accelerated Learning Cycle in mind - including Big Picture, plenary slides and repetition. (See Appendix 3 for a copy of the experimental *PowerPoint*.) The team of adults were asked not to draw attention to the plasma screens at any point during the day and to play down their importance if any student did happen to mention them.

At the end of the day, the students repeated the quiz - using the same handset as they had used in the morning. The parents were arriving to collect their children while we were repeating the quiz. It was good for them to see what their children had been doing. The students also enjoyed demonstrating the electronic voting system to them!

The following day, the students were given a short questionnaire to complete (see appendix 4), which covered:

- How well they thought they had performed on the quiz;
- What, if anything, had helped them the second time around;
- How they felt about participating in the quiz in the morning/afternoon;
- What they thought about the electronic voting system, etc.



Example slides taken from the experimental *PowerPoint* presentation

Evidence Collected

The CPS electronic voting system and software that we used was excellent in that it offered a different, fun way of recording the students' responses. More importantly, it was a highly efficient and easy way of collecting (and collating) lots of useful information. Furthermore, the information collected by the software was made available in an Excel Spreadsheet format, which included:

- Which answer each individual student had chosen for each question;
- Whether the answer provided was correct or not. These were coded on the spreadsheet as either green or red, respectively, making it very easy to see any general shifts in performance levels;
- Overall response times across the whole quiz;
- The number of correct answers achieved by each student - shown as both a percentage and a score out of ten.

Overall, the CPS software offered a fantastic way of generating a range of data which could be analysed and used as part of the final research report.

In addition, the following day, a paper questionnaire was used to establish the students' views about the technology used, the questions themselves and how easy/difficult they found them and their performance in the quiz (see appendix 4 for a copy of this post-questionnaire). The follow up questionnaire was also designed to find out if the students had noticed the information on the plasma screens and, more importantly, if they specifically

attributed any improvement in their performance to the availability of this information.

The role of Learning to Learn

The L2L philosophy is already embedded in the CPR Learning Space ethos and is included in the framework for many of the programmes and activities undertaken at the CPRLS. However, even though this is the case, L2L enabled us to make these elements more explicit and also to focus on one or two specific areas.

In the case of this research project, the focus was Resourcefulness and Remembering. The L2L project provided a vehicle and an impetus to investigate the use of the plasma screens, something which we thought worked and had an effect - but needed to 'quantify' its effectiveness in order to make use of it in a much more efficient and systemic way.

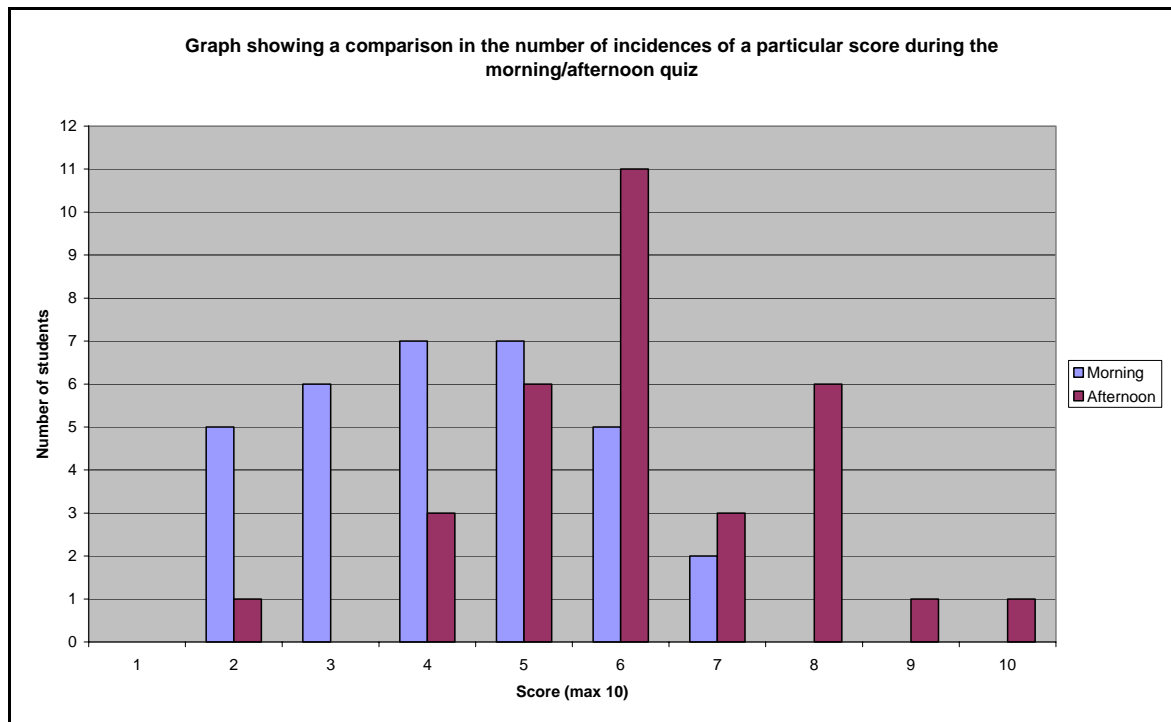
Even though the CPRLS aims to be an experimental and innovative learning environment, it was hoped that being involved in the Learning to Learn Phase 3 Evaluation would give what we do a more 'scientific' grounding/backing.

DISCUSSION OF RESULTS

Findings

Although we were already aware that using plasma screens were an important way of helping students learn, this research project aimed to measure the effectiveness in a more rigorous way. Once this was established we would be able to maximise our existing learning environment through the use of the plasma screens.

YEAR THREE PROJECT 2005/2006



Graph showing the overall distribution of scores on the morning quiz compared to the afternoon quiz.

The experiment was designed in such a way that if the plasma screens had had an impact on learning, the students' performance would improve when they repeated the Coastal Processes Quiz in the afternoon. The data collected and presented in Excel spreadsheet format, colour coded for correct (green) and incorrect (red) answers, clearly showed that the performance of the group as a whole had improved dramatically. When the information was looked at in more detail, a number of interesting results were revealed.

Quiz comparisons

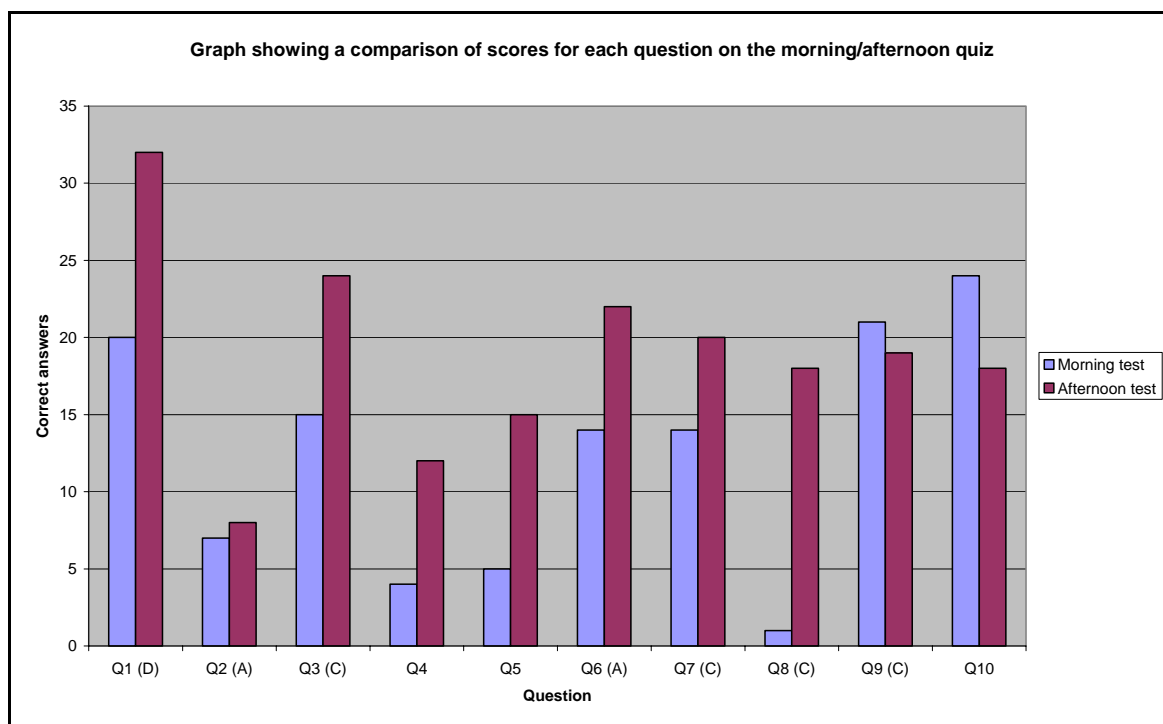
A comparison of the morning/afternoon results showed that the majority of students had improved their scores (25/32 participants). The average score on the morning quiz was 4.2 correct answers, compared to the average afternoon score of 6.2. Three students obtained the same results on both quizzes and a further four

actually decreased (by one to three incorrect answers).

On the follow up questionnaire the students were asked how much better they thought they had done on the quiz the second time around. Within the sample of 18 of the original 32 students, a total of 83% (50% better, 33% much better) thought that they had reached a higher score the second time around. (78% did actually increase their score.) This suggests that the students felt much more confident the second time around and were aware of the fact that they had learnt some of the information during the day.

As expected, given the information above, the overall distribution of scores altered with a skew towards the lower scores during the morning and the opposite during the afternoon. (See graph above.)

YEAR THREE PROJECT 2005/2006



Graph showing the overall increase in scores during the afternoon quiz on the majority of the questions

More importantly, the increase in scores between the morning and the afternoon quiz was statistically significant ($P < 0.001$, using a Paired t-test). It was also found that the use of the plasma screens throughout the day to provide the information in an implicit way had an effect size of 1.23. This is very good and higher than the average for an educational innovation (which is 0.4). This strongly supports the original hypothesis and suggests that the use of plasma screens is a highly effective medium for providing information to students in a way which encourages learning quickly and simply. However, the sample size was relatively small and the experiment would need to be replicated with a much larger sample in order to be more confidence in the results.

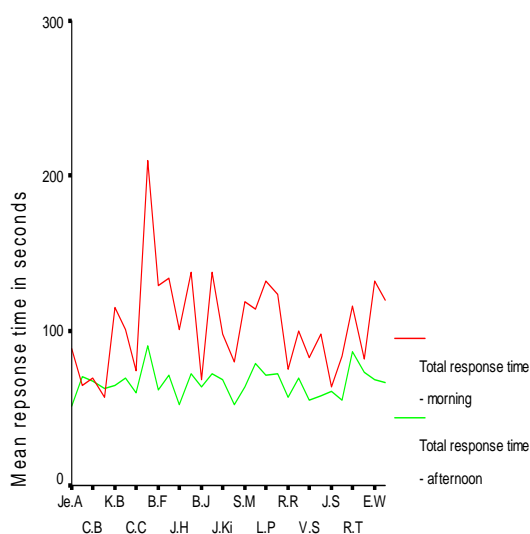
A comparison of the morning and afternoon results showed an increase in scores on all of the questions, except questions nine and ten - which showed a slight drop in correct responses during the afternoon quiz (see graph above). Both questions were about land shapes and were hard, but not the

hardest. The afternoon quiz was done right at the end of the day and we were running slightly late and the parents had started to arrive to collect their children.

We explained to the parents about the research project, giving them the same information as the students and invited them in to see what the students were doing. The students were keen to demonstrate the electronic voting system to the parents and the atmosphere remained relaxed. However, the students may have been getting more aware of the time and started to rush through the last two questions. This may explain why the responses on these questions did not follow the trend shown on all of the other questions. However, this idea is slightly contradicted by the fact that the largest increase in scores was seen on one of the later questions - number eight ('What is saltation?').

Interestingly, in addition to the increase in correct responses, the overall response times decreased: during the morning the

average response time across all ten questions was one minute 44 seconds, compared to one minute six seconds in the afternoon. Following on from the previous comment regarding the activity running late, the faster response times would seem to support this idea. However, overall the scores increased, so the faster response times could be interpreted in a number of ways:



Graph showing response times for students in the morning and afternoon surveys

- the students felt more comfortable with the set up, both with the technical equipment and the quiz itself;
- the students were more confident about the answers because they had learnt them (in some way- to be discussed later) during the day; and
- the time of day may have affected their response speeds.

All of these interpretations can be supported by the students' comments on the follow-up questionnaire when asked how they felt doing the quiz in the morning:

VERY SCARED!

Very tired

Half asleep

Confused (x3 students)

Worried as mostly guessing

It was weird because I just woke up

...compared to how they felt doing the quiz in the afternoon:

READY FOR ACTION

Better because I had seen the answers on the screen

Better as I knew I had learnt more than before

It was better because I wasn't so tired

Wide awake

YEAR THREE PROJECT 2005/2006

More confident

I had more time to see the screens around

Much better, less tense

In each room there were TV monitors

In addition to the statistical evidence, which strongly suggests that the plasma screens had a positive impact on the students' scores, the comments from the students support this conclusion. On the follow up questionnaire the students were asked why they thought they had scored differently the second time around. Eight students (out of a sample of 18) explicitly mentioned the plasma screens as instrumental in their improvement:



VJing workshop - very focused!

They were showing the answers on the screens

A further six mentioned being able to 'see the answers', for example:

The slide shows around the place

We had more info from the first

Looking at the screens around the rooms

I was able to memorise and get to see the answers

We had seen the answers in the pods

There were animations on the screens about the questions

The screens - I had more time to study them

This response was slightly ambiguous. The students could have been referring to seeing the answers during the morning quiz; but as discussed later, (see 'Extensions and changes to method' section) it was not possible for them to 'cross reference' the correct letter with the corresponding answer (e.g. they would have had to remember just the letter). The other explanation could be that they were referring to seeing the answers on the plasma screens. Although this seems the most likely interpretation, it is difficult to draw any concrete conclusions from their comments.

However, overall the students were both aware of the plasma screens and, more

importantly, were able to link their improved scores to the screens.



Students working in the Learning Space

Although this link is not in doubt, how 'peripheral' this learning was remains unclear. One of the students commented that they had deliberately watched the screens throughout the day to learn all of the information. This obviously contradicts the subconscious/peripheral idea. Incidentally, this student was the only one to achieve the maximum score (10/10)!

However, the structure of the day would suggest that this was not the learning method of the vast majority of the students. The day on which the experiment was conducted was an extremely busy one for the students. It was their last chance to sort out their final presentation for the invited audience the following day; as such they were busy rehearsing, making costumes/masks/props, writing scripts, organising running orders, etc. In addition, they were also taking part in a VJ workshop in one of the rooms, which was very intense (involving music, light and video effects) and required the students to be focussed on a large projection screen on the front of the room. They were also completing their 'Green Screen' videos, again an extremely focused activity.

We were unsure how much notice they would actually take of the screens and were concerned that the experiment would not show any effect as the information on the plasma screens was not immediately

relevant to any of the activities that they were doing on that day. In fact, all of the CPRLS team adults commented that they were unaware of the plasma screen! Furthermore, the visiting adult who participated in the experiment said that he did not know how they had time to notice the screens as they had been so busy and on task for the whole day.

With these circumstances in mind (e.g. a) Primary task very focused and intense; b) primary task not directly linked to the information being shown) it makes the increase in scores all the more remarkable and shows that the focused screens are a powerful medium through which to learn. It also shows that the learning experience was optimised, making use of all of the available resources to help the students acquire very specific content in addition to the high demands placed on them for the task they were already completing.

Gifted and Talented

We were able to identify if any of the participating students are on the CPR Success Zone's Gifted and Talented register (collated from information from all Zone schools). Nine of the sample of 32 were on the register. This enabled us to look at their scores and see how they had performed as a sub group. The highest score obtained in the morning (7/10) was achieved by two students - both of whom were on the G&T register. During the afternoon quiz, ten students obtained scores above average (e.g. seven to ten), six of whom were on the G&T register. However, when analysed using an independent t-test, no significant difference was found between the results from students identified as G&T and students not on the register. This was seen as a positive result as it suggests that the impact of the plasma screens is equally successful across different ability groups.

Gender Differences

We also looked to see if there were any differences in the performance of boys and girls. The table below shows the total scores for the morning and afternoon quiz:

		Girls (N=20)	Boys (N=12)
Morning	Total Score	72	63
	Average	3.6	5.25
Afternoon	Total Score	122	71
	Average	6.1	5.9

Table giving mean scores of boys and girls

The boxes shaded in yellow show that these average scores were equal to or greater than the overall average (for boys and girls). This shows that the boys appeared to score better than the girls in the morning and vice versa in the afternoon. Interestingly, there was a greater increase in girls' scores on the afternoon quiz than the boys', which may suggest that girls were more receptive to the use of the screens. However, when the gender difference was analysed in more detail using an independent t-test, no significant difference was found between the results for the boys and the girls. Again, this was seen as a positive result - the use of the plasma screens increased scores regardless of gender.

Voting System Feedback

The use of the CPS Electronic Voting System was a huge success. As already mentioned, it enabled a range of valuable information to be collected and collated into a spreadsheet quickly and easily. The students loved using the handsets and this was reflected in their comments on the follow up questionnaire when asked what they thought of the voting system:

Great - 10/10

It was clever and better than normal voting systems

I thought it was good because it was different.

I thought it was quite fun!

Really cool!

One of the adults who was visiting for the day to run the performance skills workshops also took part in the project and he seemed to enjoy the activity as much as the students!

I just loved playing 'Who wants to be a millionaire on the hand consoles!

The students appeared to enjoy all aspects of this activity and it added another element to the experiment, making it much more fun and giving them the opportunity to try something different.

A feature of the Summer Challenge, as is evident in all CPR Learning Space programmes, was that the adults were learning alongside the students. Although this was explicitly mentioned throughout the week, it was felt that the way the project was introduced and explained to the students was a good way to role model and reinforce this element. It was particularly good that everyone took part in the activity, adults and peer tutors were included.

Extensions and changes to the method

The biggest change for the project from the initial method was the use of the CPS Voting System. Originally, the students' base knowledge was going to be assessed through the use of a Mind Map®/brainstorm. This would then be added to at the end of the day to establish what/if the students had learnt from the experimental *PowerPoint*. Although a small pilot experiment was conducted, it was very difficult to draw any conclusions from this form of evidence - the Mind Maps proved to be unsuitable for this type of project as it was open to ambiguity and was much less rigorous.

Based on these findings, the design of the experiment was adapted slightly, with the use of the electronic voting system having the biggest impact. The use of the quiz introduced the students to the relevant information, with a particular emphasis being the use of the specific vocabulary that was also included in the experimental *PowerPoint*. This enabled us to establish exactly the information that the students had learnt as a direct result of the experimental *PowerPoint*. Again, this was something that was not possible using the Mind Map® method- which was much more open ended and less rigorous. Furthermore, the software enabled us to present individual scores, compare morning and afternoon scores, show which questions had the biggest increase in correct answers etc. - again, something that would not have been possible with the original design.

However, although the use of the electronic voting system and the corresponding software was a huge success, there was still a slight problem that may need to be changed if the experiment is repeated. During the morning quiz, after all of the students had voted, the pattern of responses was shown in a bar chart format (again, the same as is shown on 'Who wants to be a millionaire?'), with the correct answer indicated by a different colour bar.

After the first four questions, we realised that showing the answer in this way may have an impact on their responses during the afternoon. This was quickly altered so that a bar chart was still displayed; showing which response was the most 'popular', but the difference was it wasn't shaded to indicate the correct response.

Based on this, it could be argued that the improvement in results between the morning and afternoon quiz on questions one to four was due to the fact the students had already seen the answers and, therefore, the information on the experimental *PowerPoint* on the plasma screens had no effect on their learning. However, this explanation would seem to be highly doubtful. Even though they may have seen which answer was the correct one (eg. A, B, C or D), they did not have the opportunity to refer back to see which description/word was represented by this letter. Remembering just the correct letters would seem unlikely and would be a very shallow form of remembering - not likely to be of much use during the afternoon quiz.



Green Screen filming

When the 'feedback' slides showing the response bar graphs were shown, the students enjoyed seeing whether they had chosen the most popular response. It could be argued that the students remembered which letter had the most responses; however the most popular response may not have correlated with the correct answer so this strategy would not have resulted in the improvement in

scores. During the morning the students enjoyed the competitive nature of the activity - they liked racing to see who would be the first ones to respond (this was indicated on the projection screen by their initials being highlighted in yellow). It may have been this alone that motivated them to remember the correct letters. Although, this argument falls short when you consider that the students did not know that they were going to be retested at the end of the day - this was not mentioned, or even implied, at any point.

Initially, the project aimed to look at subconscious learning. However, as the project progressed this was altered and the word 'subconscious' was replaced with 'peripheral'. The reason behind this was that subconscious learning would be very difficult to quantify. In addition, as the students had already been introduced to the topic this would have made the subconscious element less likely. This is supported by feedback from the students, showing that they were very much aware of the plasmas and realised their importance - suggesting that the learning was possibly more conscious than subconscious. The word 'peripheral' was chosen as it provides a more accurate description of what was actually happening and is suitable on two levels:

1. The plasma screens were displayed around the room therefore, literally, accessing the students' peripheral vision.
2. The information that was displayed was learnt in a peripheral way, that is, it was not central to the primary task that the students were completing on the day.

Another alteration made to the original method was that a control group was not included. Initially, the experimental presentation was only going to be shown in one of the rooms and, as the students

would be in two groups this would have resulted in an experimental and a control group. The method was adapted and was incorporated into the Summer Challenge timetable, which was already busy, for both staff and students. Furthermore, the students had access to all of the rooms, which would have made it very difficult to maintain a distinct control group.

In summary, if the experiment was to be repeated (which would be important, to increase confidence in the results) the changes which would need to be made are:

- The sample size would need to be increased.
- The students would need to be split into a control and an experimental group. We would need to ensure that the students worked in the same room for the whole day, (i.e., the control group would not have access to the experimental presentation).
- While completing the quiz, the answers would not be shown on the screen. This would clarify whether the students had just remembered the correct letters or whether the increase in scores was solely due to exposure to the *PowerPoint* presentation.
- The students went on a trip to the beach earlier on in the week. Even though the information on the *PowerPoint* presentation was not discussed, the experience would have made the topic relevant to them, but it may also have 'primed' the students to take in the information. It would be interesting to do the quiz without the added visit to the beach, or to complete the quiz before the visit. This would show how much of an effect the visit had on the students' scores.



Students working with the experimental PPT running in the background- as you can see, NO-ONE is looking at them!

CONCLUSION

Developing this approach

The L2L strategy that was used was very successful. However, as would be expected, the research has now sparked a range of ideas that could be investigated and developed in the future.

Age groups

The research sample mainly consisted of Year 6 and 7 students (no significant difference was found between these two age groups). It would be interesting to investigate how different age groups (i.e. across a larger range) respond to the experimental method. This idea was based on the observation that the one adult who participated in the experiment had an above average score on both the morning and afternoon quizzes. However, the increase did not seem to be in proportion, that is, it only increased by two correct answers. This increase was below the average and was low when you consider that some of the students increased their score by as many as 4-6 correct answers. This suggests that the plasma screens may have had less of an impact on the adult learning than it appears to have had on the students. However, the difference in performance may simply be due to the different role that the adult had during the day.

As the students were not told that they would be repeating the quiz at the end of the day (which would have provided the motivation for some of them), it could be implied that it was their natural curiosity that helped them 'notice' the information on the plasmas, link it to the morning quiz and use it to their advantage during the afternoon quiz.

It would be interesting to compare the proportional increase in scores across different age groups - to determine to what degree age affects the positive impact of the plasmas.

Depth of memory

The design of the experiment meant that increases between the morning and afternoon scores were taken as an indication of how much the students had learnt during the day. This method was used as it enabled us immediately to see the impact of the experiment. However, the disadvantage of this method was that it only measured a shallow form of learning. The students would need to be tested again after a set time span (e.g., week) to see how well the facts, concepts and information had been retained. This would demonstrate how effective the technique is in terms of longer term retention of learning, whether it can be used on its own or would need to be used in conjunction with other strategies.

Comparison of rooms

During the experiment, the relevant *PowerPoint* was on display in all three of the main learning spaces in which the students were working. The structure of the day was such that the students were able to move between the three rooms and took part in pre arranged activities in each of the rooms. However, it would be interesting to compare the improvement in scores across the three rooms - especially as there are only two screens in the X-Change, therefore providing less exposure to the experimental *PowerPoint*, or less

alternative *PowerPoints* to distract from the experimental one.

Timing

There could be two areas for development based on timings:

- 1) The experiment was conducted following the trip to the beach. The trip may have already activated the students' curiosity and interest in the coastal topic and this in conjunction with the quiz in the morning, may have increased their motivation to seek out the relevant information. The project could be repeated with a trip to the beach following the experiment or the quiz could be conducted without the context of a visit. This would clarify how much of an effect the prior visit had on scores.
- 2) The actual timing of the *PowerPoint* slides could be adjusted. In the case studies on which this research is based, the fact that the slides were constantly changing (and, in one case, were changing very rapidly) was highlighted as an important factor. Add this to the fact that peripheral vision is known to be highly sensitive to movement (for further information see useful website) and the implication is that it is crucial for the slides to move if the peripheral learning mode is to be activated. As the *PowerPoint* included animations, this would have, hopefully, encouraged the students to use their peripheral vision. However, it would be interesting to alter the transition speed of the slides to see what impact this has, if any, on the students' learning.

PowerPoint Structure

The research has highlighted ways in which we could improve our use of the plasma screens and *PowerPoints*. For example, whenever possible, we will now try to use animations, to illustrate topics and concepts, as this is utilising both a

strong visual and peripheral (via movement) format. In addition, this was the first time that we have used the Accelerated Learning Cycle to provide a structure for *PowerPoints* (e.g. give the Big Picture, introduce the topics and then summarise what has been included). Although we do not know if the addition of this underlying structure had any effect, it seems like a logical format to use, especially as it mirrors the framework of most of the CPRLS learning programmes. These are two immediate changes that we will make as a direct result of this research.



VJ workshop

Summary

In conclusion, the project was a huge success. It reached its aims in that it showed that the plasma screens can be used to have a positive effect and, furthermore, quantified the impact (i.e., the difference between the morning and afternoon scores was significantly different). The research highlighted how ICT can be used creatively to utilise the students' natural curiosity and internal motivation (two very powerful, if underused, learning tools) and access the peripheral learning mode, through the strong use of visual images.

BIBLIOGRAPHY

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Smith, A. (1998) Accelerated Learning in Practice (2nd Edition), Network Continuum Education, London

Smith, A. (2002) Move It: Physical Movement and Learning (Accelerated Learning S.), Network Educational Press, London

University of the First Age:
<http://www.aoy.org.uk/main.php>

USEFUL WEBSITES

For further information about peripheral vision see:

http://en.wikipedia.org/wiki/Peripheral_vision

<http://www.2simple.com/>
2Simple Animation Software

<http://mind-map.com/EN/Indext.html>

APPENDIX 1

Challenge Framework

- 1) **Challenge based** - This includes a scenario/story that provides a reason for the activities and a big picture. It includes an outcome and a deadline, but the product/end result is left open. The challenge format enables the activity to be relevant and needs-led. Consistently we have found that if pupils see the point and understand what they are doing, are enabled to make decisions about their learning and experience success, they love their learning and become self motivated, confident and independent learners. (*Resilience and Resourcefulness*)
- 2) **Roles and responsibilities** - We encourage pupils to take responsibility for their own learning. We encourage them to decide what needs to be done successfully to complete the challenge and then to use this action plan to organise who will do each part of this - enabling everyone to feel included and valued and to ensure that everyone is clear about their individual role as part of the whole team. The action plan can also be referred to throughout the activity to see what still needs to be completed-enabling pupils to be independent. Adults are encouraged to take on more of a facilitator role, as opposed to (perhaps a more traditional) leadership role. (*Readiness and Resilience*)
- 3) **Success criteria** - At the start of the activity, pupils set their own goals and then self-evaluate both throughout the activity and during the debriefing session. In this way, assessment actively engages the learner and facilitates meaningful goal-setting. (*Resilience and Reflection*)
- 4) **Personalised learning** - We try to include VAK (visual, auditory and kinaesthetic) approaches in all of our programmes in a cohesive way, with particular emphasis on the kinaesthetic learning style. We aim to provide an immersive learning experience, accessing 4 senses (minus taste), in an attempt to make the learning more relevant and therefore memorable to the learner. In addition, we encourage students to use a range of thinking tools (eg. Mind Maps®, Odd One Out, Six Hats etc), which they can then transfer to other learning environments. (*Resourcefulness and Remembering*)
- 5) **Presentation** - Pupils are encouraged to demonstrate their learning in a variety of ways, often in a Show and Tell presentation. This could take a number of formats (eg. music, performance, ICT presentation, display, 3D sculpture, etc.) or a combination of these. (*Reflection, Resourcefulness and Remembering*)
- 6) **Feedback** - We use PMI (positive, minus, interesting) grids as a way of collecting evaluation quickly and simply in the majority of our programmes/activities. In addition, to more detailed feedback when they return to school (eg., what they have learnt, how their learning was different to school, etc). We also regularly use Mind Maps® and Brainstorming as a way of accessing what pupils already know about a topic, as well as what they would like to know. This is then extended at the end of the activity to include what they have learnt. (*Reflection and Remembering*)

APPENDIX 2

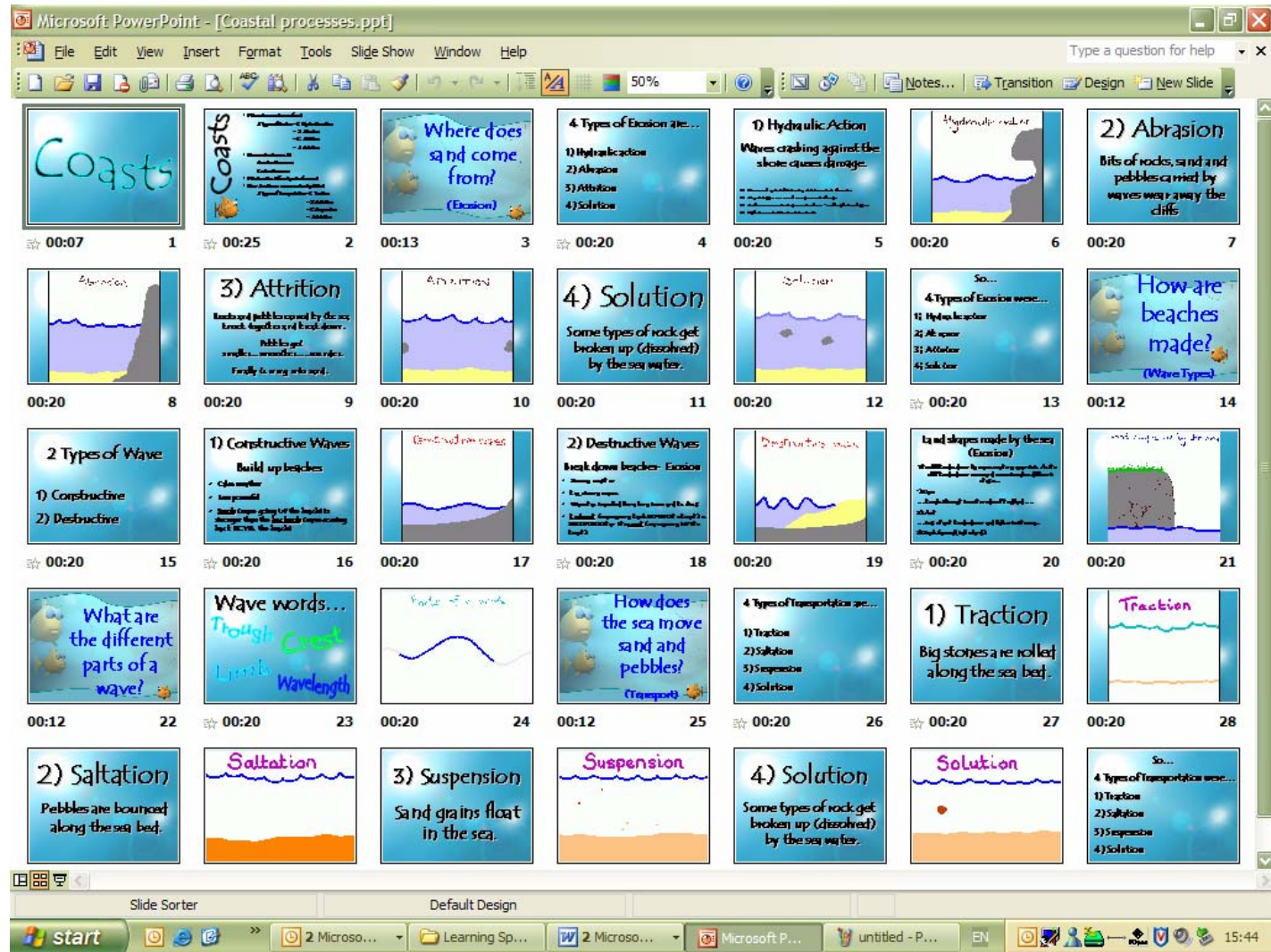
Coastal Processes Quiz

1. Which one of these DOESN'T make sand?
 - a) Waves crashing against cliffs
 - b) Stones smashing against cliffs
 - c) Stones smashing against cliffs
 - d) Stones floating in the sea
2. 4 types of erosion are...
 - a) Hydraulic action, abrasion, attrition, solution
 - b) Hydraulic action, abrasion, traction, solution
 - c) Hydraulic action, abrasion, suspension, traction
 - d) Hydraulic action, saltation, suspension, traction
3. Hydraulic action is...
 - a) 2 rocks breaking as they smash together
 - b) Rocks smashing against cliffs
 - c) Waves crashing against cliffs squashing air into cracks
 - d) Rocks dissolving in sea water
4. Beaches are built up...
 - a) When the waves are closer together
 - b) With more powerful waves
 - c) With more powerful backwashes
 - d) In calm weather
5. 4 types of transportation are...
 - a) Saltation, abrasion, attrition, solution
 - b) Traction, saltation, suspension, solution
 - c) Traction, hydraulic action, suspension, solution
 - d) Traction, abrasion, suspension, saltation
6. The movement of big stones along the sea is called...
 - a) Traction
 - b) Saltation
 - c) Suspension
 - d) Solution
7. What is the name for the part of the wave between the crest and the trough?
 - a) Trough
 - b) Crest
 - c) Limb
 - d) Wavelength
8. Saltation is...
 - a) Stones rolled along the sea bed
 - b) Sand grains floating in the sea
 - c) Pebbles bounced along the sea bed
 - d) Stones dissolved by sea water
9. Which one of these is NOT a landshape made by the sea?
 - a) Cave
 - b) Arch
 - c) Trough
 - d) Stack
10. Landshapes are made in which order?
 - a) Cave, arch stack
 - b) Arch, stack, cave
 - c) Cave, stack, arch
 - d) Stack, arch, cave

NOTE: Correct answers are highlighted in red

APPENDIX 3

Full PowerPoint slide shown on plasma screens



APPENDIX 4

Post questionnaire for students

1. How much better do you think you did on the quiz the second time around?

Worse	
Same	
Better	
Much better	

2. Why do you think you scored differently the second time around? Give details....

3. What did you think of the voting system?

4. How did you feel doing the quiz in the **morning**?

5. How did you feel doing the quiz in the **afternoon**?

6. What would have helped you do better?