ICT-in-Education - impact scenario

No.1 – Four times the learning with forums in Science

Abstract – Pupils were asked, for homework, to provide an answer in an online forum to the question "Which has more energy, an iceberg or a kettleful of hot water?" A class discussion followed in the next lesson.

Compared to holding this discussion in class after the pupils had invidually prepared an answer for homework, it is estimated that overall the time spent and quality of discussion in considering this issue amounts to four times the learning happening in the approach using an online forum.

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Level of impact –enhances existing processes of learning (transitional)

Impact on who? –Students and the teacher

Particularly relevant issues – None, could equally apply in the majority of schools.

Scenario - From a conversation during a study of learning platforms in 2005. In discussing how they were using the learning platform they had installed, Kevin Allack, the head of science at Oakbank School in Keighley explained that knowing all the pupils could access the platform out of class, he had decided to try a new approach. At the end of a recent lesson he set a forum question for homework. Just in the last couple of minutes of the lesson with no discussion he said "OK – homework; all of you provide an answer to this question in the online forum, "Which has more energy, an iceberg or a kettleful of hot water?"

This resulted in:

- all the pupils put an answer in the forum; none wished to be very visibly seen to have not done the homework.

- the more timid pupils were able to contribute as much as they wished, without the fear of criticism to their face that they felt in class.

- the less able pupils read what the brighter pupils wrote, before devising their own version of the answer they liked best.

- the brighter pupils engaged in some debate about each others' answers, exploring several threads.

- Kevin was able to see all the pupils' answers in a single place, so was more easily able to identify the common misconceptions that would have to be corrected next lesson.

- In the next lesson he was able to 'ground' the pupils more quickly, as they could each see their own contribution and could remember some of the other contributions they had looked at and thought about.

- And he had accessible some pupils' answers to lead the debate, that looked at the problem from their viewpoint. Such as the pupil who said "I'd pour the kettleful of water over the iceberg, and if all of the iceberg melted then the kettle has more energy!".

Previous approach - Analysing this learning process relative to holding the debate in class, with pupils individually preparing an answer for homework:

- It would have been hard to get all of the pupils to contribute in class.

- the forum approach gave more thinking time, continually stimulated by new postings.

- the debate was multi-threaded instead of pursuing only one thread at a time.

- there was higher order discussion amongst some pupils, which would have been difficult to develop in class while keeping focus on the key principles.

- there were more different approaches to answering the question available to the pupils to consider.

- the teacher saved time in preparation.

- the teacher had higher quality and quantity of responses from the pupils to plan how to approach the discussion next lesson.

- the work could be done by each participant at a time when they were receptive to it.

Some of these things are hard to measure, such as quality of attention - though teachers assess this constantly in class. But even just looking at the total time committed by the pupils to engaging with the question and the higher quality of discussion, we could surely have a headline "Four times the learning with ICT!".

Quantification

This quantification is an estimate. By talking to the teacher and pupils iand looking in detail at the postings on the forum it would be possible to refine these rough estimates.

Previous approach.

At home - The time time pupils spend individually thinking about the question for homework to prepare an answer will vary from zero by the dis-engaged pupils to probably 15 minutes by those who properly justify their answer. In a roughly normal distribution we can estimate this as:
- 10% (3 pupils) will spend 15 minutes = 45 minutes
- 20% (6 pupils) will spend 11.25 minutes = 67.5 minutes
- 40% (12 pupils) will spend 7.5 minutes = 90 minutes
- 20% (6 pupils) will spend 3.75 minutes = 22.5 minutes
- 10% (3 pupils) will spend 0 minutes = 0 minutes
Total 225 minutes = 7.5 minutes/pupil on average.

In class:

In a 30 minute discussion some pupils will listen attentively for the full 30 minutes (except when contributing themselves) but some will not. If we assume a normal distribution in a class of 30 pupils some pupils will have no intention of contributing and will not bother to listen properly and engage with what they are hearing in any depth. This could be estimated as:
- 10% (3 pupils) will listen for 100% of the time, 30 minutes = 90 minutes

- 20% (6 pupils) will listen for 75% of the time, 22.5 minutes = 135 minutes
- 40% (12 pupils) will listen for 50% of the time, 15 minutes = 180 minutes
- 20% (6 pupils) will listen for 25% of the time, 7.5 minutes = 45 minutes
- 10% (3 pupils) will listen for 0% of the time, 30 minutes = 0 minutes

A total of 450 minutes, average 15 minutes/pupil.

In this aproach pupils on average engage, during homework and in class, for 22.5 minutes in total.

Approach using the online forum.

At home - If the discussion is held online, every pupil knows that they need to contribute something in order to be seen by their classmates to have done the work expected. Pupils who contributed early are likely to be those that are engaged and some returned to the forum to see whether others agree with them and commented further. Those less engaged will wait until others have contributed, so they have ideas to copy. The likelyhood that all pupils will read at least the first few lines of sufficient contributions to be able to choose the answer they prefer is high. Some pupils will read all the answers of the other pupils.

If we estimate that it takes 30 seconds to scan at least the first few lines of each pupil's contributions, then even the least engaged students will engage with the question for 5 minutes while scanning, with another 5 minutes to add their own contribution, a total of 10 minutes. The most engaged will look at all the other pupils' answers for say a minute each on average, say a total of 29 minutes. The most engaged also contributed more than one posting to the forum, so we can estimate the time they spent contributing as say 10 minutes, making their total engagement 39 minutes. Taking a normal distribution again:
- 10% will enage for 39 minutes = 117 minutes
- 20% will engage for 31.75 minutes = 190.5 minutes
- 40% will engage for 24.5 minutes = 294 minutes
- 20% will engage for 17.25 minutes = 103.5 minutes
- 10% will engage for 10 minutes = 30 minutes

A total of 735 minutes, average 24.5 minutes.

In class – There are two factors that will increase the engagement and degree of listening that the pupils will do in the class, the first being that fact that they have contributed an answer and have an interest in knowing if the answer was right or wrong, the second being that the teacher knows what answer they gave, and they know the teacher knows. The teacher can therefore take steps to engage all the pupils more strongly. We can therefore estimate that the least engaged will listen and engage for at least the start of the discussion, with some chance of them taking an interest in the issue itself. If we estimate the least engaged concentrate for a 20% of the time:

- 10% (3 pupils) will listen for 100% of the time, 30 minutes = 90 minutes
- 20% (6 pupils) will listen for 75% of the time, 24 minutes = 144 minutes
- 40% (12 pupils) will listen for 50% of the time, 18 minutes = 216 minutes
- 20% (6 pupils) will listen for 25% of the time, 12 minutes = 72 minutes
- 10% (3 pupils) will listen for 20% of the time, 6 minutes = 18 minutes

Total 540 minutes, 18 minutes/pupil.

Therefore in this approach pupils engage, in homework and in class, on average for 42.5 minutes, which is 1.8 times as long as in the previous approach – nearly double the time.

It is then necessary to consider the quality of the discussion between the two approaches.

In the previous approach the pupils had no stimulus during the home work to challenge their current conceptual understanding of how energy and temperature are related. They will therefore create an answer based on their current perception with little deep thought about the issue. In the online forum based approach, all the pupils have the challenge of seeing the different ways other pupils justify their answers and will be provoked to some level of thought.

In the class discussion, in the previous approach the teacher would have had to spend the first part of the discussion eliciting opposing views from the pupils, before he could move on to the conceptual basis that needed to be discussed. In the online forum based approach he could start the discussion by contrasting responses already made by the pupils. He could also use pupil's own ways of looking at the issue, such as the pupil who answered "I'd pour the kettleful of water over the iceberg, and if the iceberg all melted then the kettle has more energy."

Both from the point of view of pupils having the stimulus of challenge to their ideas during the homework, and considering the class discussion could spend all the time discussing the conceptual issues instead of only half the time, it is realistic to estimate that the quality of the learning happening is doubled.

So with both time spent and quality of learning approximately doubling, it is reasonable to say that the online forum based approach enables around four times the learning of the approach that does not use ICT.

Case Study/Full Description – tbc

Caveats - none

New skills (teachers and pupils) inc SEAL and PLTS - tbc

Other evidence already available – the pupils' answers on the online forum could be analysed in more depth to assess time spent and quality of thinking.

Next steps in quantifying the impact - tbc

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Keywords - tbc

Date – The conversation that is the basis of this impact study took place in 2005. This impact study was written Nov 2010.