Flipped learning in science

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Overview

Question

Will flipped learning improve the progress of Year 11 science students?

Project aims

- To improve year 11 progress towards their progress 8 + 1 target through the addition of flipped learning activities prior to each lesson
- to improve students' confidence when answering higher level exam questions by dedicating time in the lesson to higher level tasks.

Rationale

- I decided on this project because I have a class of students where the majority of students have a progress 8 +1 target of A and above. These students are currently struggling to achieve their target and so I feel that I need to plan my lessons differently in order for them to progress further in science.
- Too much time is spent covering the lower levels of Bloom's taxonomy and this usually involves tasks which students are capable of doing in their own time. Giving the students these lower level tasks in a flipped way allows them more time in the lesson to address misconceptions and develop higher level exam practice.

Project outline

- Plan a topic of work where the vast majority of the lessons are flipped, for a description of how to flip lessons see Lewis Moore's OCR project on flipped learning
- use these flipped activities to identify and correct any early misconceptions that the students may have
- use the lesson time to focus on higher level tasks and exam practice
- at the end of the unit assess the impact flipped learning has had on the students' progress.

Impact

For this project, I used a treatment class and a control class. The treatment group (11Sc1) received all of their lessons in the flipped format whereas the control group (11Sc2) received normal lessons throughout the topic. At the end of the topic, the progress between the two groups was compared.

- In the flipped class the progress 8 score improved by an average value of 2.22 (from -1.22 to +1) compared to the non-flipped class where the average score improved by only 0.57 (from -1.07 to -0.5)

- of the students who received the lessons in a flipped format 94% (17/18) of students achieved a higher grade in their end of unit test, compared to 43% (6/14) of students in the non-flipped class

- in the flipped class 13/18 (72%) of students achieved their progress 8 target, 85% (11/13) of which managed to surpass their progress 8 target, compared to 50% (7/14) in the control group.

A summary of this information can be found on the following page.

11 Sc1 - Flipped group								
Name	P8+1 Grade	P8+1 Value	B2b Grade	B2b Value	B2b P8	B3a Grade	B3a Value	B3a P8
1	A	7	D	4	-2	A*	8	2
2	B	6	A	7	2	A*	8	3
3	B	6	A	7	2	A*	8	3
4	A	7	C	5	-1	A*	8	2
5	A	7	U	0	-6	D	4	-2
6	A	7	A	7	1	A*	8	2
7	B	6	B	6	1	A*	8	3
8	A	7	C	5	-1	B	6	0
9	B	6	B	6	1	A*	8	3
10	A*	8	C	5	-2	A	7	0
11	B	6	U	0	-5	D	4	-1
12	A*	8	B	6	-1	C	5	-2
13	A	7	B	6	0	A	7	1
14	B	6	A	7	2	A*	8	3
15	B	6	U	0	-5	D	4	-1
16	C	5	C	5	1	B	6	2
17	A*	8	D	4	-3	A*	8	1
18	A	7	U	0	-6	C	5	-1
P8 Average					-1.22222			1

11 Sc2 - Non-flipped group								
Name	P8+1 Grade	P8+1 Value	B2b Grade	B2b Value	B2b P8	B3a Grade	B3a Value	B3a P8
1	D	4	E	3	0	F	2	-1
2	B	6	C	5	0	B	6	1
3	C	5	D	4	0	G	0	-4
4	C	5	C	5	1	D	4	0
5	B	6	B	6	1	A*	8	3
6	B	6	B	6	1	B	6	1
7	A*	8	U	0	-7	C	5	-2
8	A	7	D	4	-2	U	0	-6
9	C	5	C	5	1	D	4	0
10	D	4	U	0	-3	C	5	2
11	C	5	U	0	-4	E	3	-1
12	B	6	C	5	0	A*	8	3
13	D	4	F	2	-1	F	2	-1
14	B	6	E	3	-2	E	3	-2
P8 Average					-1.07143			-0.5

- At the start of the topic three students were slow to adopt the new teaching approach and did not complete the flipped tasks (students 11, 15 and 18). As the topic progressed and students recognised the benefit of the flipped tasks these students were convinced to complete the flipped homework adequately.

- One students (12) did not complete any of the homework tasks, this is reflected in their test data as they achieved a lower grade in the test compared to previous test data. Possible solutions to this are covered later.

Impact in a different context

- I continued to flip lessons with the flipped group and began implementing flipped learning with the non-flipped group. The original group managed to maintain their progress from the previous topic where the newly flipped class improved their progress by an average value of 1 (-0.5 to +0.5).

- In addition to the previous groups I rolled out a new scheme of work with all year 9 students. This scheme of work implemented a flipped learning approach for all staff to use with the students. From the end of topic assessment data it was shown that high ability students' levels increased by an average of 2.18, middle ability students' levels increased by an average of 2.49 and low ability students' levels increased by an average of 2.3.

Impact in a different subject

- As part of this project the mathematics department implemented flipped learning into their schemes of work. To do this they set students a MathsWatch video along with interactive questions for the students to answer prior to the lesson. The teacher would then look at the students' responses prior to the lesson and would plan their lesson with the aim to correct any misconceptions straight away. Once the misconceptions had been dealt with, students were provided differentiated tasks based on their understanding of the task.

- As a result of these flipped tasks they found that students progressed much faster in lessons and as a whole made much more progress each lesson. In addition to this they found that students were more confident in class.

- In addition to the increased student progress, flipped learning allowed the students to cover content at a faster rate which provided more time to develop their exam technique.

Student comments

The following comments were taken from students in the class which received the lessons in a flipped format:

"I really like being given the chance to practise working on exam questions, I went into the exam much more confident than I have in the past."

"At first I didn't like having so much homework but after a while I saw the benefit as I started to better understand the lessons."

"Flipped homework is much easier than usual homework, I can do this homework easily on my own where before I used to find the homework difficult."

"I really enjoyed lessons this term, I learnt a lot in lessons and felt confident going into the test."

How to…

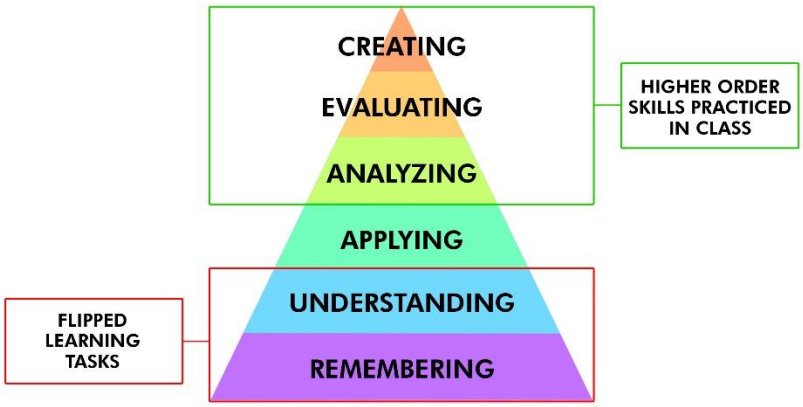
Plan lessons using a flipped approach

- Look at lesson outcomes, identify the tasks in your lesson which cover the lower levels of Bloom's Taxonomy. These tasks tend to require low level thinking skills such as 'identify', 'define' and 'label' tasks which students can easily complete on their own.

- The students may need to be directed towards a resource, website or a video in order to focus their learning. This will ensure students cover the appropriate content for the lesson and do not waste their time completing the task in an unsuitable manner.

- The flipped task should then be covered at the start of your lesson to ensure any misconceptions are corrected at an early stage. At this point a teacher is able to identify students who are proficient in the subject and can be challenged further as well as students who will require additional support.

Bloom's Taxonomy



Adapted from Learn NC: Link

- It is wise to ensure you have a task available for students who failed to complete the flipped task. Often I set them the flipped task to complete, these students would then be required to take a different path through the lesson to ensure learning objectives are met.

Deal with students who are unwilling to complete the flipped homework

- The following table shows the common challenges which I faced throughout the duration of this project and how I dealt with them:

Challenge	Solution
Students found it difficult to locate information to complete the flipped task to a sufficient standard.	Provide resources (website or a short video) on the Class Site which allow students to identify easily the content required.
Students unwilling to complete homework.	After school detentions where the students were given additional work in order to allow them to catch up with the other students.
	Contact parents or guardians to explain the benefit completing the flipped tasks will have on the student's progress.
	Students missed out on a fun activity such as a heart dissection and instead completed their flipped homework.
	Segregated students from the rest of the class to prevent them from hindering the progress of students completing the more challenging tasks.

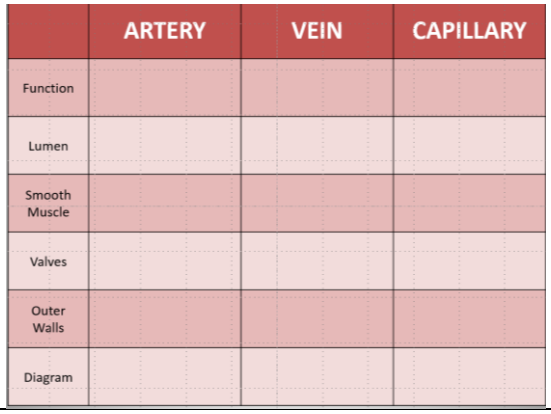
- Despite all efforts I was still left with one student who was unwilling to complete any of the flipped homework tasks. Once the test data was released and the student could see that they were the only students to make negative progress on their last test this was enough to encourage them to do the flipped homework tasks in future.

References

- Lewis Moore. (2014). *Flipped Learning.* Available: http://www.ocr.org.uk/about-us/what-we-do/supporting-education/shireland-collegiate-academy/flipped-learning/.

Appendix

Flipped lesson examples

Lesson title	Lesson objectives	Flipped task
Active transport	• Describe the process of active transport • analyse the similarities and differences between active transport from diffusion and osmosis.	Define active transport. Provide examples of active transport in animals and plants.
Circulation of blood	• Compare the different blood vessels in terms of size, structure and function • explain how the structure of each vessel relates to its function • evaluate how artificial blood can aid circulation.	Students complete the following sheet to identify the similarities and differences in the structure of blood vessels. 
Ventilation	• Describe how the alveoli and villi are adapted • analyse how these adaptations allow these exchange structures to function effectively • evaluate the use of artificial breathing aids.	Describe how the following breathing aids assist ventilation. What are the benefits and drawbacks of each method? • Iron lung • the shell • positive pressure ventilation.