2016 cohort

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How does prior learning impacts students' subject attitudes and engagement in Physics for 12-13 year olds?

Attainment is an enormous matter; and there is a huge number of strategies proposed to increase attainment in schools. One of the strategy that is becoming increasingly popular is the flipped-classroom model, in which activities completed in classrooms traditionally become homework, and homework activities become classroom activities (Sohrabi & Iraj, 2016).

In a flipped classroom environment, active learning is involved, and the students are responsible for their individual learning progress (Lai & Hwang, 2016). Activating prior knowledge through out-of-class activities is a common practice used in a flipped classroom model (Fig. 1). This is due to the fact that prior knowledge can positively affect students' motivation and learning approaches (Winters, Greene & Costich, 2008). As shown by many past research, high prior knowledge students usually use a more active learning approach and therefore, showed better performance (Akcayir & Akcayir, 2018). Past research also demonstrated enhance student satisfaction and increase in level of engagement (Bhagat, Chang, & Chang, 2016, Bosner, Pickert, & Stibane, 2015; Khanova, et al., 2015).

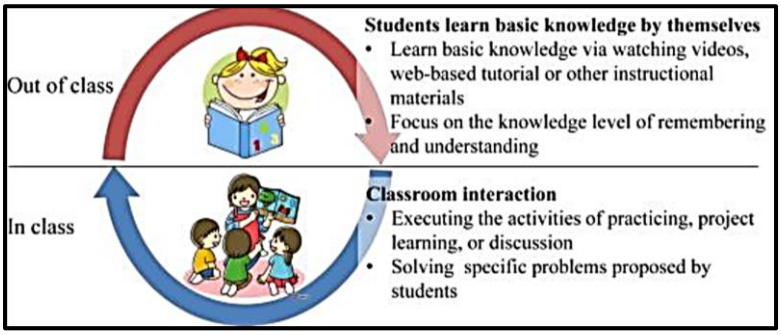

Figure 1: Flip Learning Model (Bergman & Sams, 2012).

This study, therefore, aims to evaluate the effects of implementing out-of-class flipped-learning activities to activate prior knowledge. The intended impact of the intervention is to improve students' attitudes towards Physics and enhance engagement in Physics lesson. If the intervention proved to be successful, it is hoped that the Science Department will implement this strategy with higher frequency to boost subject attainment. Figure 2 illustrates the logic model to summarise the intervention strategy, intended outcomes and factors to be considered during this study.

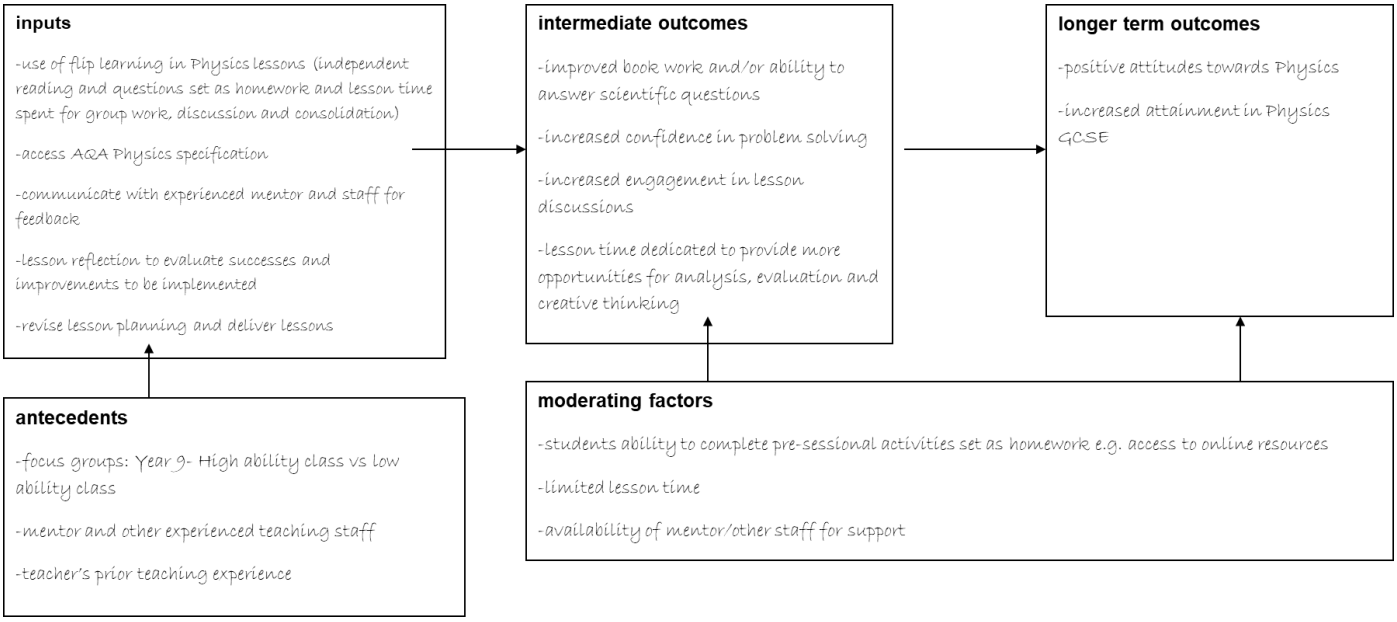

Figure 2: Logic Model

Research methodology:

The following method was used for the intervention:

1. Reading and instructional videos will be given as homework prior to the topic being taught in class (flipped-learning strategy). The instructional videos are intended for students of low reading comprehension ability, ensuring that they can access the knowledge required.
2. Peer assessment of homework will be done in class. Misconceptions will also be addressed at this stage (Lesson 1).
3. Baseline test will be given to assess initial topic knowledge (Lesson 1).
4. Lessons 2-4 will be used to provide opportunities for learners to create, evaluate and think creatively.
5. Final assessment will be given to assess final topic knowledge and understanding (Lesson 5).
6. Learners will be given reflection tasks to evaluate their progress and assess the impact of the strategy.

Findings and analysis:

The following summarises the results gathered from survey 1 (pupil voice), which was collected prior to the intervention to gauge pupils' attitudes towards the subject:

1. 13% of the focus group dislike Science

2. 54% find Science challenging; 20% found it too difficult

3. Majority of the students would choose Science if given a choice as they think the subject is beneficial for their future; whereas a small percentage of learners preferred not to study Science as they find the subject too difficult

4. 27% of the students do not enjoy Physics in particular as they find the subject too difficult

The following are observations gathered after the delivery of the intervention:

1. Flip Learning Lesson 1: News presentation

The pupils presented their learning outcomes to the class in form of a news presentation. The lesson facilitated opportunities for the learners to analyse, evaluate and develop creative thinking using their enhanced prior knowledge. Overall, the lesson was very successful in encouraging full engagement from each individual. The pupils also commented on their increased subject confidence due to their enhanced prior knowledge of the topic made possible through the independent learning homework task given prior to lesson delivery.

2. Flip learning lesson 2: Renew-a-bean

Lesson 2 was delivered to the target group. In this lesson, the learners were given opportunities to apply their subject knowledge (and enhanced prior learning) to complete an investigation on renewable energy; analyse and evaluate their results to form valid conclusions. The learners were encouraged to think creatively to provide explanations for their results and suggest improvements for the investigation. This lesson was very successful in encouraging class engagement and also allowing social development (SMSC) through teamwork.

3. Flip learning lesson 3: Joule Island

Lesson 3 was delivered to the target group (91A). In this lesson, the students played the role of scientists working in teams to plan and design energy generation systems that can be built in Joule Island. The students were encouraged to use their subject knowledge to think critically, and work in teams to come up with a plan of action and set of solutions for the scientific problems given. As a deliverable, the teams had to present their ideas and concepts to the class where these are peer assessed. The teams were then encouraged to intellectually challenged the decisions made by other teams. Rewards were given to the team with the most compelling design and immediate, differentiated verbal feedback were given to individuals.

4. Flip Learning lesson 4: Energy and the Environment

Lesson 4 was delivered to the target group (91A). In this lesson, the students, in teams, were assigned an energy resource. A debate challenge was delivered and the learners had to argue/justify why their energy resource is more superior than others using their subject knowledge. the learners had to think critically and creatively to pose defense statements backing their arguments, as well as pose questions to challenge other teams. The debate challenge was successful in ensuring 100% engagement from all learners. The challenge also helped developed a growth mindset among teams who initially thought they were given the "less superior" energy resources.

Flip learning strategy assessment

Summative assessments were delivered to help assess the impact of the flip learning strategy. Interestingly, some students gained more marks on the assessments after lesson delivery whilst others maintained similar scores. From the pupils reflections gathered, it was evident that the independent learning homework given prior to the lesson delivery helped the pupils gain prior knowledge of the subject, increasing their confidence of the topic in class. It was however very much apparent also from learners' reflections that a deeper subject understanding and confidence were far greater after lesson delivery.

The data gathered for this project still requires more analysis and additional evidence to be able to make valid conclusions.

Conclusions and recommendations:

From the preliminary analysis of the results gathered, the flipped-learning intervention delivered facilitated the activation/enhancement of prior learning and positively improved their attitudes towards the subject. The intervention lessons delivered provided opportunities for the learners to analyse, evaluate and develop creative thinking. From lesson observations and pupils' reflections, the learners were more engaged in class and confident in their subject knowledge.

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