Embedding ‘flipped’ learning and metacognitive strategies into Year 12 Biology lessons to improve student outcomes

Nicola Manning, Alison How & Tanja Hofmann

Abstract

Extensive past and recent research has shown that heightened metacognitive skills have a significant impact on student outcomes. The Biology team at ONE has been exploring ways of integrating development of these skills into Year 12 lessons; by **modelling metacognitive techniques** as well as encouraging **independent learning and self evaluation**. Results indicate that ‘learning how to learn’ has a **substantial impact on students’ progress** towards ALPS in standardised Biology assessments.

Aims

- *Develop resources that provide students with structured **’flipped’ independent learning activities** for selected ‘easy’ AS Biology topics*
- *Re-structure lesson time to focus on ‘**higher’ skills development** via modelling and practice of subject-specific exam skills, as well as cognitive and metacognitive strategies*
- *Develop resources that enable students to regularly **self-evaluate the effectiveness** of their learning and adapt their strategies*

Introduction

Evidence for the effectiveness of ‘flipped learning’ is patchy from studies conducted up to keystage 4, however there have been some promising findings at college and university level. Heyborne & Perrett (2016) found that the ‘flipped learning section’ **scored more highly** than the ‘lecture section’ (control) in all but one examination. Similarly, Talley & Scherer (2013) reported that flipped learning along with self-explanation and practice **testing increased the final course grade** over previous semesters in a study of undergraduate psychology students. Both Dunlosky et al. (2013) and Thirtle (2014) have presented evidence that engagement of students in self assessment is beneficial to metagcognitive development and, more recently, a guidance report by the EEF on ‘Metacognition and self-regulated learning’ has outlined clear evidence for the benefits of developing both independent learning and self-evaluation in students, with **significant impacts on student outcomes** demonstrated (EEF, 2018).

Methodology

Three Year 12 Biology teaching groups were involved in this project, taught jointly by two members of the teaching team. **Two intervention (double: n=14 and single: n=15) and one control group (n=12)** were set up at the start of the academic year. In the double intervention group, both teachers implemented flipped learning and metacognitive strategies, in the single intervention group only one teacher did. The control group was taught as per previous academic years. Interventions consisted of: 1) Structured **flipped learning homeworks** of content in advance of each lesson, 2) **Student evaluation** of effectiveness of their independent learning, 3) Teacher modelling and practice in lessons of **subject-specific (exam skills), as well as cognitive (learning strategies) and metacognitive skills** (self evaluation), 4) Student **self-evaluation of outcomes** following assessments using ‘exam-wrappers’
Statistical analysis consisted of a c**omparison of students in-class standardised assessment scores normalised against ALPS targets between intervention and control groups** using paired t-tests (same assessments compared).

Results

A comparison of progress against ALPS between intervention and control groups showed that the double intervention group performed better in all but three assessments and the single intervention group in all but two assessments (Fig.1). **Mean progress made was significantly higher in both groups** (by 0.32±0.41 of a grade in double intervention, t= 2.74, p<0.05 and by 0.39 ±0.41 of a grade in singe intervention, t=3.58, p<0.01).

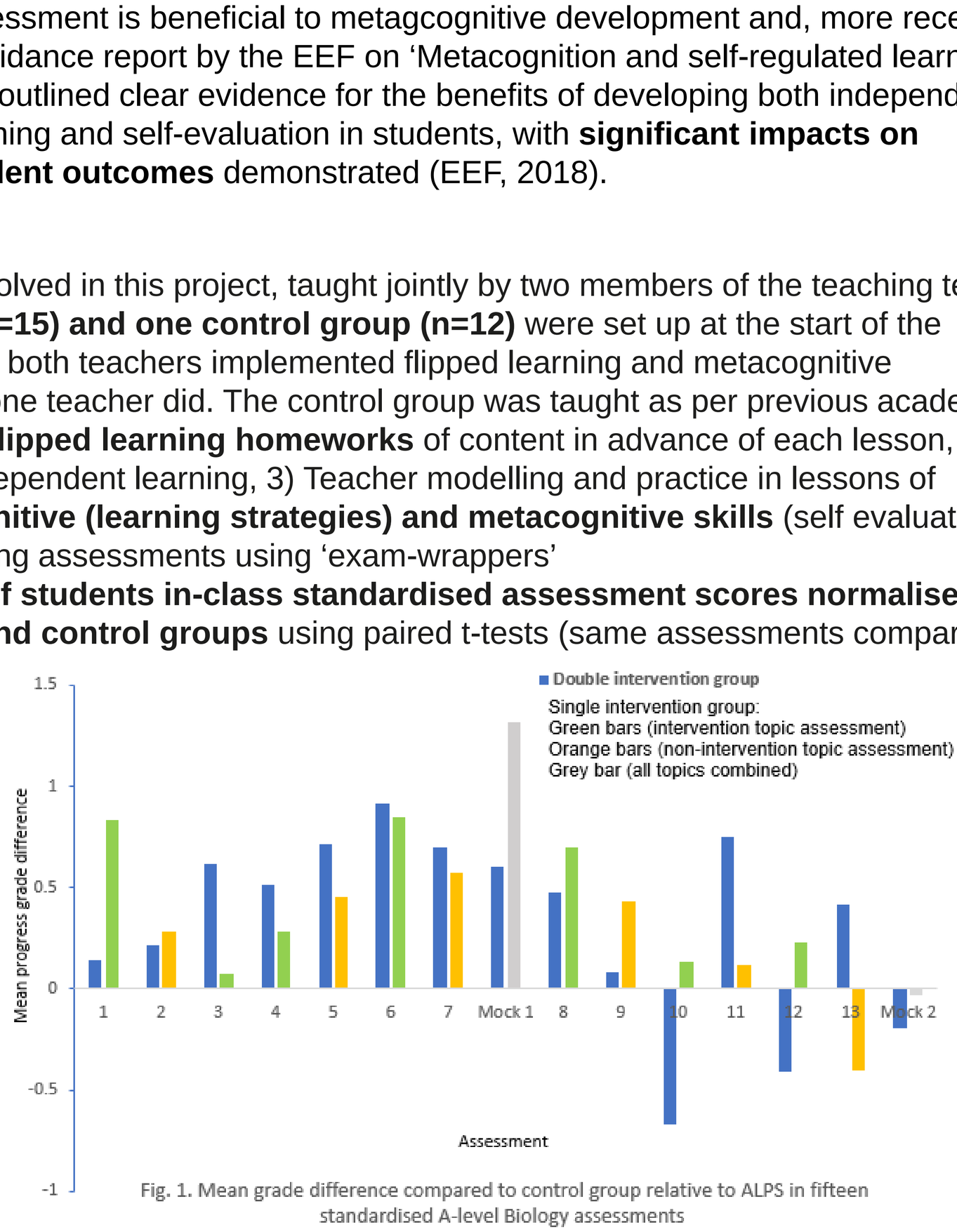

Fig. 1. Mean grade difference compared to control group relative to ALPS in fifteen standardised A-level Biology assessments

Discussion

A clear and significant positive impact of metacognitive strategies on mean progress could be demonstrated in this study for Year 12 Biology students, confirming the guidance given by the EEF (2018). Interestingly this was not mirrored in the final Year 12 mock examinations (mock 2, Fig.1), although the differences in progress scores between control and intervention groups were not significant for this assessment (t=0.473, p>0.05). More detailed analysis of the exam paper questions is needed, as there may be differences between skills-based vs. knowledge recall questions linked to metacognitive development, which would continue to endorse this approach to prepare students for the generally more skills-demanding A-level papers at the end of Year 13.

References: Dunlosky J., Rawson K.A., Marsh E.J., Nathan M.J. & Willingham D.T. (2013). Improving students’ learning with effective learning techniques: Promising directions from cognitive and educational psychology. Psychological Science in the Public Interest, 14(1), 4-58; Education Endowment Foundation (2018). Metacognition and self-regulated learning. Guidance report. https://educationendowmentfoundation.org.uk/tools/guidance-reports/metacognition-and-self-regulated-learning/ ; accessed May 2018; Heyborne W.H & Perret J.J. (2016). To Flip or Not to Flip? Analysis of a Flipped Classroom Pedagogy in a General Biology Course. Journal of College Science Teaching, 45(4), 31-37.; Talley C.P. & Scherer S. (2013). The Enhanced Flipped Classroom: Increasing academic performance with student-recorded lectures and practice testing in a ‘flipped’ STEM course. The Journal of Negro Education, 82 (3), 339-347.; Thirtle S. (2014). Self-assessment in learning: the relationship between active feedback strategies and metacognitive development. Eprints.hud.ac.uk, accessed May 2018.