Combining Self-Assessment and Peer-Instruction to Enhance Learning and Teaching Effectiveness (0361)

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This paper details the principles of a teaching methodology that combines Self-assessment and Peer-instruction with the aim to mutually re-enforce the positive effects generated by both pedagogies. In the first part of the paper, we critically review the core features of Self-assessment and Peer-instruction. Next, we highlight how these features can be seamlessly blended within a teaching algorithm that alternates a class discussion and collaborative learning component, with a reflection and self-regulation component. Our methodology makes intense use of Student Response Systems (SRS) to facilitate both components, and to support an easy implementation in large class environments. Using data collected through SRS technology, the second part of the paper develops an empirical analysis to evaluate the effectiveness of our pedagogy. Refining earlier empirical investigations, and a well-established quantitative methodology, our preliminary results confirm the presence of a synergy between Self-assessment and Peer-instruction, and validate our pedagogical design.

Self-assessment and Peer-instruction are two powerful pedagogies, both at the centre of a lively debate in HE learning, teaching, and assessment practices. Further to the marketization of the HE sector, and the global raise of participation in tertiary education, both pedagogies represent an effective response to the challenge of providing a personal student experience within larger and larger class environments, and with the increasing pressure to minimise staff and resources costs, and maximise the benefit of contact time with the students (Boud, 1995, and Bishop and Verleger, 2013). Aside from the more materialistic and market-driven motives, Self-assessment and Peer-instruction are pedagogies arguably at the core of the well-established Student-centred Learning paradigm, as they have been recently embedded within different and many examples of good teaching practice in HE (Nicol and Macfarlane-Dick, 2006, and Crouch and Mazur, 2001).

In his seminal contribution on the role of Self-assessment in HE, Boud (1995) highlights the pivotal role of this pedagogy in forming lifelong learning skills, and creating an effective learning environment where students can develop Academic Self-efficacy (Bandura, 1977 and 1997, Pajares, 1996, and Chemers *et al.*, 2001), student Self-regulation behaviours (Zimmerman, 2002), as well as Student Motivation (McMillan and Hearn, 2008). However, while the investigation on Self-assessment practices seems to represent a widely and better established field in HE research (Boud and Falchikov, 1989), rigorous studies on Peer-instruction effectiveness are still restricted to a limited number of disciplines. Further to Mazur's (1997) seminal contribution on the role of Peer-instruction in learning, this teaching technique was predominantly applied and researched in Physics education (Henderson and Dancy, 2009) and other STEM subjects (Perez *et al.*, 2010). Peer-instruction facilitates the creation of an active-learning environment where students are engaged in a sequence of multiple choice quizzes. For each question, in the first stage, students commit to an answer independently from one another. In the second stage, students are encouraged to compare their answers, and to exchange information aimed at identifying a correct response. In the third stage, students respond again to the question asked in the first stage. An explanation about the question asked and about the correct answer is offered, until a new Peer-instruction cycle starts again with a new problem to solve.

A limited number of studies have explored the robustness of Peer-instruction to alternative pedagogical designs. For instance, Nicol and Boyle (2003) conduct a comparative analysis showing

that Peer-instruction is more effective than class-wide discussion. Nielsen *et al.* (2014), instead, demonstrate that an increase in the individual 'thinking-period' granted to students during Peer-instruction improves student's perception of its effectiveness, even though the most productive discussions only involve a restricted number of class participants. With the aim of improving student's self-monitoring and reflections skills (Henderson and Harper, 2009), our contribution also develops a modification of the standard Peer-instruction algorithm, with a stronger emphasis on Self-assessment. In line with Nielsen *et al.* (2014), we argue that benefits of Peer-instruction can be magnified if students are led to reflect on their abilities prior to engaging in collaborative discussion. At the same time, we also support Boud's view that: '*organising self assessment with an element of peer discussion or feedback can be very desirable*' (Boud, 1995, p. 200). Thus, we propose a framework that blends Self-assessment and Peer-instruction as equal partners in the facilitation of student learning. According to our pedagogical design, students: (i) provide a first response to each question, (ii) evaluate their performance in each answer given, (iii) compare and discuss their answers with their peers, and (iv) give a second and final response to each question asked.

While our teaching methodology aligns more closely to Kolb's (1984) learning cycle, alternating experience and reflective observation, in the second part of the paper we empirically test the implications of our approach on teaching effectiveness. We exploit a rich dataset collected over multiple Peer-instruction sessions within a large-class core undergraduate module. Data recorded through SRS technology allows us to track student responses over all the stages of Peer-instruction, and to correlate students' answers to formative assessment questions to individual self-evaluations of their performance. To measure self-assessment performance, we investigate the association between correct (incorrect) answers to formative questions and confident (not-confident) self-assessment statements. Thus, we compute the difference between the proportions of correct responses to formative questions, as they were given before and after Peer-instruction, to construct a measure of the learning gains generated in each session, which represent the empirical indicator of effectiveness of our teaching algorithm. Our preliminary results display positive correlation between self-assessment performance and learning gains, suggesting that embedding Self-assessment practices within the Peer-instruction algorithm increases the teaching effectiveness of this powerful pedagogy.

While the empirical analysis presented in this paper is predominantly based on indicators constructed at class-level, further research will aim to: (i) disentangle the relationship between self-assessment and learning gains at student-level, and (ii) gather students' perspectives on the pedagogy we have developed. We envisage that an analysis that controls for the composition of the student population will offer new insights on the effectiveness of this pedagogy, and further opportunities to enhance learning within a heterogeneous student population.

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