Metacognition in higher education: How academics think and how they teach students to think

In higher education (HE) students are expected to take responsibility for their learning. However, students who enter HE from the highly supportive school environment often struggle with assuming this responsibility and establishing suitable study methods (Nuade, Nel, van der Watt & Tadi, 2016). There are many facets to learning, including planning, utilising appropriate studying strategies, monitoring progress, evaluating comprehension, and reflecting on the efficacy of learning approaches. The ability to be aware of and regulate these learning processes is called metacognition.

Metacognition is broadly defined as "thinking about one's own thinking" (Georghiades, 2004, p. 365). Two commonly described domains within metacognition are knowledge and regulation of cognition (Flavell, 1976). Knowledge of cognition incorporates: declarative knowledge (the ability to describe one's cognitions and cognitive strategies), procedural knowledge (how to put cognitive strategies into practice), and conditional knowledge (knowing when to use each strategy; Schraw & Dennison, 1994). Metacognitive regulation describes the control of cognition which can take place before, during and/or after a cognitive endeavour, for example through planning, monitoring and evaluation (Schraw & Moshman, 1995).

Metacognition has been extensively researched within education (Zohar & Barzilai, 2013). A metacognitive student has been described as one who knows how to learn because they appreciate what they know, what they must do, and the relative merits of different approaches to acquiring and understanding new knowledge (Wilson & Bai, 2010). Consequently, metacognitive ability has been significantly associated with academic performance across all levels of education (Swanson, 1990; Adey & Shayer, 1993; Young & Fry, 2008) and within HE the relationship between metacognitive ability and academic performance is as strong as the impact of socioeconomic status or intrinsic motivation on academic performance (Richardson, Abraham & Bond, 2012). Intervention studies have

demonstrated that students' metacognitive ability can be enhanced (Dhieb-Henia, 2003; Jones, Antonenkot, & Greenwood, 2012).

Despite the wealth of research into metacognition at all levels of education, a gap has been reported between metacognition research and the inclusion of metacognition in teaching practice in primary and secondary education (Zohar & Barzilai, 2013; Georghiades, 2004). In other words, previous studies have found that school teachers are mostly unaware of metacognition and how it can be incorporated into their teaching practice to benefit their students. Consequently, this study investigated whether the metacognition research-practice gap reported in primary and secondary education extended to HE. Specifically, the research questions were:

1. To what extent are lecturers aware of metacognition?
2. Is metacognition included in teaching practice in HE?
3. What is the relationship between metacognition in academics' own research practice and their teaching practice?

Ethical approval was granted by the appropriate review committees at Queen Mary University of London (where the research was conducted) and University College London (which had academic oversight of the research).

An online questionnaire and semi-structured interviews evaluated awareness of metacognition among 72 academics working in the scientific disciplines of biochemistry, biomedical sciences, biological sciences, medicine, chemistry and psychology. The questionnaire and interviews identified that only the minority of participants had heard of metacognition: female academics and those working in psychology were significantly more likely to be familiar with the concept ($\chi^2(1) = 4.639$, $p = .031$ $\phi = .254$ and $\chi^2(6) = 19.378$, $p = .004$ $\phi = .519$ respectively). None of the respondents reported explicitly including metacognition in their teaching practice.

In order to assess the extent to which students' metacognitive ability was supported implicitly through teaching practices, questionnaire respondents were asked to indicate how often they used each of 16 metacognitive methods. All respondents incorporated at least two metacognitive methods in their teaching practice (M = 11.76, SD = 3.38). The most commonly used metacognitive methods involved asking students to reflect on their prior knowledge and to articulate their understanding; the least commonly used methods included constructing concept maps (also known as mind maps) and asking students to categorise their thinking (for example as recall, understanding, application or analysis). Academics with a teaching qualification reported significantly greater inclusion of metacognitive methods in their teaching practice than academics without a teaching qualification ($t(70) = -3.74$, $p < .001$). Inclusion of metacognitive methods in teaching tended to increase with teaching experience only for academics without a teaching qualification, although this finding was not statistically significant.

This study also developed the Metacognitive Awareness Inventory for Academics (MAIA) which measured academics' metacognitive ability in their research practice. Factor analysis of data from the 24 Likert scale rated items yielded a two-factor solution with high internal consistency; the factors aligned with the theoretical dimensions of knowledge and regulation of cognition within metacognition. Responses were used to calculate participants' scores for knowledge (M = 64.78, SD = 7.46) and regulation (M = 33.07, SD = 6.68) of cognition in their research practice: these scores were strongly and significantly correlated with each other (r = .636, $p < .001$, two tailed). Furthermore, regulation of cognition in research practice was strongly and significantly correlated with inclusion of metacognitive methods in teaching practice (r = .503, $p < .001$, two-tailed respectively). The relationship between knowledge of cognition in research practice and inclusion of metacognitive methods in teaching practice was moderate and significant (r = .363, p = .002, two-tailed).

These findings suggest there is scope for a professional development programme for academics with teaching responsibilities in HE. The programme should have three aims: to raise

awareness of metacognition, equip academics with pedagogic knowledge about metacognition, and support the inclusion of metacognitive methods in teaching practice.

In conclusion, this study identified that the metacognition research-practice gap exists in HE, similar to the gap reported previously in primary and secondary education. This was the first study to broadly measure the inclusion of metacognition in teaching practice at any level of education. Furthermore, this was the first study to measure the metacognitive ability of HE academics. These findings and their implications for HE teaching will be further discussed in the presentation.

(990 words including title)

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