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Metacognitive skills of second year extended and main stream University mathematics students: a case study

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ABSTRACT

Many universities have introduced so called extended degrees where students' first year workload is spread over two years to prevent the decline of graduates in mathematics and science. It has been put forward that extended degree courses should include the explicit training of mathematics students in the use of metacognitive skills. This is based on research that shows that successful students in mathematics are able to apply such metacognitive skills and that these skills play an important role in mathematical problem solving. Such skills are concerned with the actual regulation, coordination and control of one's own learning activities and cognitive processes. Given that extended degree students generally perform weakly in mathematics in comparison to main stream students (non-extended degree students) this research study sets out to consider the differences in the use of metacognitive skills of these two student groupings.

A qualitative case study was used to investigate collaborative solving of mathematical problems of one student pair. Students were trained in the use of metacognitive skills by using the metacognitive intervention method called IMPROVE. The student pair was video-recorded during talk-aloud protocols twice before explicit training in the IMPROVE method, and after instruction in order to evaluate students' development in the use of metacognitive skills. Video recordings were transcribed noting students' verbal and non-verbal actions and the coding of transcriptions in conjunction with content analysis was used in determining differences in students' metacognitive skills. Since students worked collaboratively, instances where students acted as so-called social triggers of each other's metacognitive skills, were also investigated. With student-researcher interaction during observations, the researcher was also regarded as a social trigger of students' metacognitive behaviour. Apart from these social triggers, environmental triggers of students' metacognitive skills were also scrutinised. Environmental triggers included the effect of task difficulty and the intervention of the IMPROVE method on students' metacognitive skills. This study on the social and environmental triggers of individual's metacognitive skills contributes to the relatively young field in viewing metacognition as cognitive activity that operates on multiple levels during collaborative problem solving, and that metacognition cannot solely be explained in terms of individualistic conceptions but also by social and environmental triggers. Results from the study show that, in general, the main stream student exhibited a greater number of metacognitive skills compared to the extended degree student. Furthermore, it seems that the IMPROVE method as an environmental trigger, had an effect on the development of both students' metacognitive behaviour. Research findings of the study also reveal that the researcher's intervention mainly resulted in the students acting as social triggers for each other's metacognitive behaviour. Furthermore, it was found that there were a greater number of occurrences in which the main stream student acted as social trigger for the extended degree student' metacognitive behaviour. The level of task difficulty also seems to have acted as environmental trigger for students' metacognitive behaviour. As an exploratory study, the findings of this study are not generalizable.

Keywords:

Metacognition, metacognitive skills, extended degree, main stream degree, IMPROVE method, social and environmental triggers of students' metacognitive skills