

Identifying threshold concepts in a geomatics engineering course

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Key words: geomatics engineering, areas of troublesome knowledge, threshold concepts

Geomatics engineering is an engineering discipline encompassing the fields of surveying and mapping. As in most other engineering programs geomatics engineering students are faced with a high course load and each course is heavily packed with concepts. Over the years, instructors have anecdotally observed that students are either not able to retain certain essential concepts or the level of understanding is not sufficiently deep for them to transfer certain concepts from one context to another. This causes a necessity for reviewing fundamental concepts in class which sometimes may add up to a significant overlap in the delivered content between different courses. This paper will be a product from a teaching and learning research study conducted to identify threshold concepts in geomatics engineering. In literature, a threshold concept is defined as something a learner cannot progress without. Normally a threshold concept first appears as a difficult concept to the students. They are then “stuck” until they hopefully grasp the concept. Once a threshold concept is understood, it opens up the door for a transformative experience in their learning process. This can be expressed as something “clicking together” for the students. Thus, some of the identifiable characteristics of a threshold concept are troublesomeness, liminality, transformation, and integration. Identifying threshold concepts is beneficial for both instructors and students. Instructors can design teaching and learning activities to address these concepts, and by having a better understanding of the concepts students will become more successful in their program.

While the research study included four geomatics engineering courses, this paper will focus primarily one of them, namely “Least Squares Estimation”. This is a second-year course, and includes topics on probability, statistics and mathematical optimization related to surveying. The concepts learned in this course are applied in a number of post-requisite courses in the third and fourth years of the program. In order to identify any threshold concepts in the course three types of data collection activities were conducted: in-class observations, minute papers on muddiest concepts, and an end-of-term survey. The in-class observations are supposed to capture the type of content and instruction, and the student cognitive and behavioural engagement. The minute papers were conducted almost once every chapter and were meant to address the troublesomeness and/or the liminality aspects of the concepts. The end-of-term survey is meant to identify areas/topics of troublesome knowledge and point out certain difficult concepts within these topics. After all the collected data for the course is processed, concepts which are identified as troublesome in the in-class observations and the minute papers, and remain problematic in the end-of-term survey, will be identified as candidates for threshold concepts.