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## Individual Differences in Psychology Undergraduates' Development of Research Methods Knowledge and Skills

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### Abstract

Not all psychology undergraduates appear to benefit from participating in research methodology classes. This longitudinal study tracked how students' knowledge of research methods developed throughout their three-year undergraduate psychology degree. Card sorting procedures measuring knowledge of research methods terminology were repeated at four time-points across three years then analyzed using multidimensional scaling. There was no significant improvement in students' research methods structural knowledge after a year, but there was by the end of students' second year. Knowledge did not improve after students' final year of study. Various metacognitive and motivational variables were significant correlates of research methods knowledge and research skills. Structural knowledge of research methods terminology appears to be developed from formal methodology training and is not improved upon after completion of a final year research project dissertation. Improving metacognitive skills and increasing motivation for methodology classes may be linked to better development of research methods knowledge and research skills.

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## 1. Introduction

University students are likely to undergo research methodology training while learning how to conduct research, which teaches them about research methods and develops their research skills. In order to develop domain-specific skills, learners need to have knowledge of that domain (Kraiger, Ford, & Salas, 1993).

Research on knowledge development argues that domain knowledge begins with declarative knowledge, which is explicit knowledge about the facts of a domain (Abu-Zaid & Khan, 2013), before developing into procedural knowledge, which is the knowledge or intellectual skills related to knowing how to perform relevant tasks (Davis & Yi, 2004; Gagne, 1984; Rickards, Fajen, Sullivan, & Gillespie, 1997). An example of declarative knowledge of research methods is knowledge of which methodological approaches to use in a given situation. An example of procedural knowledge of research methods is knowing how to apply that methodological approach in that situation. With this knowledge, students can develop research skills.

The mental models of domain knowledge are also important to examine as individual pieces of information gradually become more interconnected throughout learning, transforming into organized knowledge structures of a subject area (Davis & Yi, 2004). Changes in structural knowledge are said to occur as expertise develops (Rowe, Cooke, Hall, & Halgren, 1996). Experts have been found to structure their domain knowledge more efficiently than novices to allow for faster and better access to relevant problem solving information (French & Thomas, 1987; Hong, 1999). Thus, all knowledge types should be considered when exploring the development of proficiency in a domain.

Research has shown that people engaging in a longer period of initial training can recall much of the learned content many years later, even without additional rehearsal of the information (Bahrick & Hall, 1991). However, the process of developing knowledge, as discussed above, does not account for differences in knowledge between students who have all undergone the same length, amount and level of training. Bauer and Bennett (2003) noted how alumni of an undergraduate research programme reported significant improvements in a range of skills and abilities, so there are clear benefits to being involved in research. Bauer and Bennett did not, however, take into account the factors that may have supported or inhibited these improvements in skills and abilities, which vary from student-to-student. Furthermore, while high achieving students have been found to report positive research experiences through continued engagement in research, lower achieving students have reported the opposite (Taraban & Logue, 2012), and many students have professed poor understanding of research methods despite undertaking multiple methodology training courses (Lehti & Lehtinen, 2005). Difficulties with the learning of research methods in psychology has been noted by various research (e.g. Bard, Bieschke, Herbert, & Eberz, 2000) and social science students' difficulties with research methods has been found to be unrelated to their difficulties with the other study areas of their programmes (Murtonen & Lehtinen, 2003). Some students appear to develop knowledge in this domain more readily than others, but it is not clear why. Therefore, individual differences must play a role in this development of knowledge and skills.

### 1.1. Theoretical Framework

Ackerman (1996) proposed a theory of knowledge acquisition in adult learning called PPIK (intelligence-as-process, personality, interests, and intelligence-as-knowledge) which suggests that the process of knowledge acquisition starts with the cognitive abilities of fluid intelligence (general problem solving ability) and crystallized intelligence (prior knowledge), then takes into account non-ability trait determinants of domain knowledge (such as personality, motivation and interest factors) to explain individual differences in domain knowledge (Ackerman & Beier, 2006). Thompson and Zamboanga (2004) found that prior knowledge has an effect on course achievement independently of cognitive ability or engagement. Therefore, as individuals increase their knowledge of a domain through learning, it would be logical to assume that these cognitive and non-ability factors act as facilitators and barriers to the development of knowledge and expertise.

Since knowledge is domain-specific (Rolfhus & Ackerman, 1999), the factors involved in development of knowledge in one domain might not be the same for another domain. Murtonen (2005) noted that motivation, approaches to learning and metacognitive skills are likely to play a part in students' learning of quantitative methods, and that anxiety about this learning would likely impact on students' motivation to learn. Research has

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