Chapter 6

Meaningful Individual Differences in Statistics Cognition

ABSTRACT

This chapter focuses on the understanding and use of individual differences in statistics cognition. We argue that individual differences can be classified along a continuum ranging from within an individual (internally derived) to an outside source (externally prescribed), and that where an individual differences falls on the continuum may have important implications for how individual differences are used to describe, control for, predict, or explain findings in scholarly research. We argue that individual differences are more useful when they meaningfully pertain to cognitive development, and outline how motivation (using goal orientation and self-determination theory) can be used as an individual difference. We conclude with a discussion of aligning motivational goals and how online courses could adapt themselves to student motivational profiles.

We already know that even modest amounts of statistical training can have a big impact... and we have little basis for predicting how much more improvement is feasible. - Ziva Kunda and Richard E. Nisbett, 1986, p. 222

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1. INTRODUCTION

To understand how cognition can be developed in an online statistics classroom, it is necessary to consider how cognitions are quantified (Chapter 2), the influence they have on learning (Chapter 3), their impact on the environment (Chapter 4) and relationship with affect (Chapter 5). However, the fields of statistics (Baloğlu, 2003; Walsh & Ugumba-Agwunobi, 2002) and online education (Muilenburg & Berge, 2005; Van den Branden & Lambert, 1999) commonly examine the role individual differences play in learning, with work linking the basis for such differences to automated cognitive processes (Greenwald, McGhee, & Schwartz, 1998). Such a realization is of great importance for online educators who have the ability to manipulate curriculum to suit individual student needs (see Chapter 4). However, what makes an individual difference meaningful?

In order answer this question, it is first necessary to define the term *individual difference*, and consider how they are used. An individual difference is any identified characteristic that can be used to describe, explain, predict, and control behavior (Coon & Mitterer, 2013). And while many researchers make use of these variables, a need to understand *how* and *why* traditionally used individual differences, such as age (Chyung, 2007), gender (Schram, 1996), socioeconomic status (Bornstein & Bradley, 2014), and learning styles (Yousef, 2016), are theorized to impact general educational outcomes remains (Boekaerts, 1995; Nicholls, Cheung, Lauer, & Patashnick, 1989; Voyer & Voyer, 2014).

This Chapter begins by discussing how individual differences are used in statistics cognition, with special emphasis on their sources (2.1) and how they are used (2.2). We then provide a theoretical framework for selecting more dynamic and meaningful individual differences. By meaningful, we refer to individual differences that can influence cognitive processes (3.1) and consider motivation as an example of an individual difference (3.2), detailing how to determine motivational profiles (3.3) and encourage adaptive motivation in statistical learning (3.4). We then consider how meaningful individual differences may differ when framed in an online context (4), and conclude the Chapter with a summary of what we have learned and where the field can look to go next (5).
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