# Diagnosis of Setbacks and Intervention in Introductory Programming at Scale

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## Abstract:

It can be challenging to support and motivate programming students in introductory contexts (Jenkins, 2001; Jenkins, 2002). Although computing education in secondary schools now receives more attention, due to advocacy (Livingstone & Hope, 2011; Furber, 2012) and revised curricula (Department for Education, 2013), there is still considerable variance in the programming ability of new undergraduate students. Many have little to no prior experience (Scott & Ghinea, 2014a; Scott, 2016). As a result, university teaching staff are required to apply pedagogies that are elastic. However, elastic pedagogies, such as soft-scaffolding (Scott, 2013), are non-trivial to implement in large classes. This means that it is difficult to provide enough challenge to maintain some students' interest while also being accessible enough to avoid intimidating others, and even more so when diagnosing student setbacks and implementing targeted interventions.

To this end, the authors explore practical approaches to diagnosis and intervention in large introductory programming classes. Firstly, using robot challenges and games, such as *Lego Mindstorms*, *SpaceChem* and *Blockly*, as a proxy measures for computational thinking (Zarb & Siegel, 2016; Scott, 2016). Secondly, using psychometric instruments on *SoScience* to evaluate key variables such as: self-concept; mindset; and anxiety (Scott & Ghinea, 2014b); as well as learning style (Alshaigy et al, 2015). Thirdly, using *Socrative* to apply peer instruction methods (Porter, Zingaro & Lister, 2014) to identify key areas of difficulty, such as assignment (Bornat, Dehnadi & Simon, 2008), as early as possible. Such data can be used to diagnose key issues and better inform teaching assistants on in-lab support, the design of peer-review activities, as well as CPD (continuing personal development) activities in small-group tutorials. While the validity and reliability of these approaches remains under investigation by the authors (c.f. Tew & Dorn, 2013), initial student and staff feedback suggests the approaches are useful.

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