Chapter 4
Applications of Machine Learning in Education:
Personas Design for Chatbots

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ABSTRACT

This research aims to explore how to enhance student engagement in higher education institutions using novel chatbots. This study's principal research methodology is design science research, which is executed in three iterations: personas elicitation, a survey and development of student engagement factor models (SEFMs), and chatbot interaction analysis. This chapter focuses on the first iteration, personas elicitation, which proposes a data-driven persona development method (DDPDM) that utilises machine learning, precisely a k-means clustering technique. Data analysis is conducted using two datasets. Eight personas are produced from the two data analyses. The pragmatic findings from this study make two contributions to the current literature. Firstly, the proposed DDPDM uses machine learning, specifically k-means clustering, to build data-driven personas. Secondly, the persona template is designed for university students, which supports the construction of data-driven personas. Future work will cover the second and third iterations.

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1. INTRODUCTION

Student engagement refers to the extent to which students are interested or involved in their learning and how they are linked to other students, their classes and their institutions (Axelson & Flick, 2010). Three dimensions of student engagement have been identified (Bloom, 1965): 1) behavioural engagement, represented by behavioural norms such as attendance and involvement; 2) emotional engagement, represented by emotions such as enjoyment, interest and a sense of belonging; and 3) cognitive engagement, represented by investing more time in learning beyond that required (Bloom, 1965). This study focuses on behavioural and cognitive engagement.

Student engagement has received significant attention in the literature since the 1990s (Trowler, 2010), particularly in its value for learning and achievement (Newmann, 1992). Trowler believes that "*the value of engagement is no longer questioned*" (Trowler, 2010) (p.4). Student engagement is considered a predictor of student performance (Astin, 1984; Martin & Torres, 2016)and one of the main factors behind students' boredom, alienation, low performance and high dropout rates (Martin & Torres, 2016). The literature shows that HEIs are facing a critical problem with low-level student engagement. Several teaching methods, tools and strategies have been developed to solve this problem. For example, with the significant increase in the number of internet users and mobile phone owners, there has been great interest in employing these devices in class and outside of class to improve student participation(Lim, 2017; Parsons & Taylor, 2011) and, currently, chatbots are being used in education (Abu Shawar & Atwell, 2007).

According to Trowler (2010), a large proportion of the student engagement literature reports studies in the US and Australia, with most of the research focusing on the implementation of the National Survey of Student Engagement (NSSE). Carini, Kuh, & Klein (2006) studied the linkage between student engagement and student learning. The study sample consisted of 1,058 students from 14 universities and colleges and used the NSSE survey instrument to collect the data. The instrument consists of 70 items that evaluate the effort and time that students spend on educational activities. The results of the study show that student engagement is only one factor that affects student performance.

The UK represents a small proportion of the existing literature (Trowler, 2010) on student engagement. For example, a study by Trowler (2010) concentrated on specific aspects of learning, including tools (learning management systems), techniques (particular feedback) or approaches to specific situations (inductions for distance learners). Moreover, Trowler (2010) surveyed students to measure their perceptions of these specific aspects. In UK studies on student engagement, the sample size is usually small, and the survey focuses on the experiences of a single class of a single module at a particular level.