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## Adult development in the wild: The determinants of autonomous learning in a Massive Open Online Course<sup>☆</sup>



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## ABSTRACT

The current study examines age and non-ability traits as determinants of participation in an autonomous learning activity, a Massive Open Online Course (MOOC). Framed within investment theories of adult intellectual development, we tested a model in which course performance and completion were predicted by age, trait complexes (constellations of personality variables), prior knowledge, interest, and course affective engagement. Trait complexes and interests were linked to objective course behavioral data for a sample of adult learners engaged in the course ( $N = 108$ ;  $M_{\text{age}} = 44.2$ ,  $SD = 17.3$ ). The intellectual and mastery trait complex was positively associated with finding the course engaging; no such relationship was found for the traditional and avoidance trait complex. Older adults participated in more course activities than younger adults, which led to better course performance. These findings highlight the factors that lead to continuous intellectual development through the lifespan.

### 1. Introduction

Although formal training is relevant to successful performance in everyday life, adults are engaged more often in self-directed and informal learning activities (e.g., checking out library books or taking a continuing education course at a community college; Livingstone, 1999; Masunaga & Horn, 2000; Tannenbaum, 1997). These informal learning activities support continuous intellectual development across the lifespan. Even though continuous intellectual development is important for health and wellbeing, and for active participation as a community member (Carpini & Keeter, 1996), scientists know very little about the determinants of success in self-directed development activities for adults outside of formal educational environments. Investment theories of adult intellectual development posit that continuous learning throughout the lifespan will be a function of personality and interest traits that direct attention toward learning and knowledge acquisition (Ackerman, 1996; Cattell, 1987). Because investment theories are concerned with self-directed investment of attentional resources toward development, they are particularly useful for understanding autonomous learning outside of the context of formal learning environments — that is, learning in the wild. The current study is framed within investment theories of adult intellectual development and examines the

determinants of autonomous learning in the context of a Massive Open Online Course (MOOC). MOOCs are online courses that are generally accessible to students with a computer and an Internet connection for free or at a very low cost.

#### 1.1. Investment theories of adult intellectual development

Investment theories of adult intellectual development consider the knowledge acquired through life experiences (education and work) a part of adult intellect and as such, highlight intellectual growth throughout the lifespan (Beier & Ackerman, 2001, 2003, 2005). Ackerman (1996) introduced a theory of adult intellectual development called PPIK and it represents intelligence-as-process, personality, interests, and intelligence-as-knowledge. PPIK recognizes that people invest their cognitive effort toward acquired knowledge (i.e., intelligence-as-knowledge) across the lifespan; this effort is directed by person traits such as personality and interests. Essentially the PPIK theory recognizes that — with declines in reasoning and memory abilities with normal cognitive aging — knowledge acquired through life experiences in educational, vocational, and avocational domains becomes central to adult intelligence (Ackerman, 2000).

Empirical support for the idea that knowledge is central to adult

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intellect comes from a series of studies that found positive relationships between age and knowledge in an array of academic and non-academic domains (e.g., current events, finances, health, technology, business, literature, history, world geography, and leisure activity; Ackerman, 2000; Ackerman & Beier, 2006; Ackerman & Rolfhus, 1999; Beier & Ackerman, 2001, 2003; Hambrick & Engle, 2002). Across these studies, the only domains in which age has been consistently negatively correlated with knowledge were those most related to reasoning and memory abilities (e.g., chemistry and physics; Ackerman & Rolfhus, 1999). Moreover, prior knowledge has been shown to facilitate the acquisition of new knowledge (Ackerman & Beier, 2006; Beier & Ackerman, 2005; Hambrick, 2003; Hambrick & Engle, 2002). Hambrick (2003) examined the role of prior knowledge in acquiring new knowledge in the game of basketball in a longitudinal study that took place in a naturalistic environment. He found that participants who had more prior knowledge of basketball were better able to remember new knowledge about the events of a specific basketball game than participants who had less knowledge of basketball, suggesting a role for prior knowledge in learning. In the current study, students with more prior knowledge related to course content were posited to be better able to retain new information acquired in the course, as assessed through graded course assignments, than students with less prior knowledge.

According to investment theories, a complete picture of adult intellect considers not only the cognitive elements related to learning (domain knowledge and reasoning ability) but also interests and personality traits that drive learning and intellectual development. The role of interests in sustaining engagement is evidenced by the relationships found between interest and acquired knowledge. For example, interest is positively related to knowledge in academic domains in college students (Rolfhus & Ackerman, 1996, 1999) and current events and other non-academic knowledge for adult learners (e.g., Beier & Ackerman, 2001; Hambrick, Meinz, & Oswald, 2007). Essentially, interests should lead people to engage in intellectual activities for their intrinsic reward (e.g., finding the activity to be motivating and fun; Keller & Blomann, 2008). Researchers have referred to the intrinsic value of intellectual activity as affective engagement (Flowerday & Schraw, 2003; Schraw, Flowerday, & Reisetter, 1998). People are likely to experience higher affective engagement when their interests match the activity in which they are engaged, and lower affective engagement when their interests do not align with the activity (Keller & Blomann, 2008).

In terms of personality traits related to intellectual development, von Stumm and Ackerman (2013) defined investment traits as the “tendency to seek out, engage in, enjoy, and continuously pursue opportunities for effortful cognitive activity” (p. 854). Examples of investment traits include need for cognition (person’s enjoyment of thinking; Cacioppo & Petty, 1982) and openness to experience from the big five (tendency to be drawn to and to appreciate ideas and intellectual pursuits; Goldberg, 1993). Conversely, trait tendencies related to avoiding intellectual pursuits due to a rigid approach to life are traditionalism (a conventional and rigid approach; Tellegen, 1982), anxiety (Pintrich & de Groot, 1990), and a performance-avoid orientation (tendency to avoid negative assessments of one’s performance; Zweig & Webster, 2004). These trait tendencies are generally negatively related to learning and performance in educational environments (Ackerman, Bowen, Beier, & Kanfer, 2001; Ackerman, Kanfer, & Beier, 2013).

Researchers have expanded the study of individual traits to the study of trait complexes, which are constellations of personality traits that are facilitative of, or detrimental to, learning (Ackerman et al., 2013; Snow, 1987). Trait complexes are posited to have an influence on academic achievement, performance, and knowledge acquisition because they “affect the direction and intensity of the investment of cognitive effort and ultimately lead to the differentiation between individuals in the breadth and depth of knowledge/expertise acquired during adulthood” (Ackerman & Beier, 2003, p. 4). The advantage of

the trait complex approach is that it broadens the constructs examined in research because it combines individual traits that share common variance. Snow was the first to use a trait complex approach to predict academic performance from the aggregation of various traits (Snow, 1987). This research later evolved to incorporate intellectual approach and avoidance goal orientations (Ackerman et al., 2001; Ackerman et al., 2013).

Research suggests that trait complexes associated with approach goal orientations (e.g., the tendency to engage in environments where one might learn something even if one might fail) are positively associated with success in educational environments (Ackerman et al., 2001; Ackerman et al., 2013). Trait complexes associated with an avoidance orientation (e.g., the tendency to avoid situations in which one might look incompetent or to avoid situations in which one might fail) are negatively related to learning and knowledge. In the current study, we further examine intellectual approach and avoidance trait complexes as antecedents of course interest and engagement. Prior research on investment theory and learning has been conducted in educational or laboratory environments (Beier & Ackerman, 2005; Hambrick & Engle, 2002; Hambrick et al., 2007), which can create a relatively artificial and strong situation that might limit the influence of non-ability traits for learning (Sackett, Zedeck, & Fogli, 1988). One contribution of the current study is that we examined investment theory in the context of an autonomous learning environment, a MOOC.

### 1.2. Autonomous learning and Massive Open Online Courses (MOOCs)

Our definition of autonomous learning resembles what Tannenbaum, Beard, McNall, and Salas (2010) and Livingstone (1999) describe as informal learning in that it is learner-directed and reflects an intent for intellectual development on the part of the learner. We consider autonomous learning to include formal (instructor-structured activity such as engaging in a continuing education course) and informal learning activities (self-managed activity such as researching a topic at a library; Beier, Torres, & Gilberto, 2017). Regardless of the training delivery method (e.g., formal or informal) or ultimate goal (e.g., to have fun or to gain a skill for a new job), our definition of autonomous learning is activity that is self-initiated and self-directed for the purposes of one’s own intellectual development.

Open learning platforms provide opportunities for autonomous learning. Wedemeyer (1973, 1975) identified characteristics of such platforms; open learning systems minimize barriers to entry, provide choice in course content, and allow self-paced learning. These characteristics tend to apply to MOOCs for three reasons. First, the relatively low barrier to entry in MOOCs opens them up to a broad range of student talent and intentions (Koller, Ng, Do, & Chen, 2013). Indeed, MOOCs tend to attract students from diverse backgrounds, nationalities, and interests (Brahimi & Sarirete, 2015). For instance, a review of 10 MOOCs offered at a university in the United Kingdom described MOOC participation as including adults across all age groups, from younger than 18 years to older than 66 years (Liyaganawardena & Williams, 2016). Second, a wide-range of topics are taught in MOOCs, such as mathematics, computer science, and business. Students have choices in the courses for which they register and how they engage with course content. MOOCs attract students with an array of motives for enrollment, including general intellectual development, personal challenge, exposure to potential topics for future study, and obtaining job skills (Breslow et al., 2013; Christensen et al., 2013; Gütl, Rizzardini, Chang, & Morales, 2014; Hew & Cheung, 2014). Third, students in MOOCs can access course materials at any time and at their own pace. As such, MOOCs provide open access to learning opportunities for people of all ages who want to engage in continuous intellectual development. MOOCs are thus an ideal environment in which to study autonomous learning and adult intellectual development throughout the lifespan.

Although MOOCs provide the opportunity to study the determinants

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