



# Predicting students' learning strategies: The contribution of chronotype over personality



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## ABSTRACT

Students' learning strategies as well as the search for its determinants have gained expanding interest in psychology and educational research. The present study investigated the contribution of chronotype, another construct of increasing importance in the academic context, to students' learning strategies controlling for the established predictor of personality and its relations to chronotype. A sample of 318 college students (mean age = 22.6, SD = 2.5; age range = 19–34) was assessed online through self-report questionnaires. We discriminated between two learning strategy factors aggregated by a diverse set of learning strategies, learning discipline and elaboration. First, results confirmed significant associations between most personality scales and students' strategy use. Furthermore, we found evidence for significant associations between chronotype and personality, as well as chronotype and learning strategies. Finally, structural equation modeling revealed that openness, agreeableness, conscientiousness, and morningness were significant predictors for elaboration, whereas learning discipline was significantly predicted by conscientiousness and morningness. We conclude that chronotype plays an important role explaining students' learning strategies over and above personality.

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## 1. Introduction

Factors contributing to successful learning have been of great scientific interest in the last decades, because learning and achievement are predictive of many different academic outcome variables including academic success (for a meta-analysis, see Richardson, Abraham, & Bond, 2012) and study satisfaction (Puzziferro, 2008; Spörer & Brunstein, 2005), but also mental health and psychological well-being (Tavakolizadeh, Yadollahi, & Poorshafei, 2012; Van Nguyen, Laohasiriwong, Saengsuwan, Thinkhamrop, & Wright, 2014). Therefore, a number of studies have aimed at identifying predictors for individual differences in these abilities (e.g., Donche, De Maeyer, Coertjens, Van Daal, & Van Petegem, 2013) as well as at examining between-group differences (e.g., gender differences; Ruffing, Wach, Spinath, Brünken, & Karbach, 2014) or designing interventions in order to improve the way students approach learning and study processes (for an overview, see Hattie, Biggs, & Purdie, 1996). Still, there are many unanswered

questions regarding university students' learning strategy use and the comparability of previous findings is limited, partly because of the heterogeneity of theoretical perspectives, measurement instruments and terminologies adopted in prior studies (for a review, see Entwistle & McCune, 2004). The search for predictors of successful strategy use is of particular importance regarding the early identification of students who may require special support (e.g., specific instructions or presentation styles) or trainings. A construct that has been frequently examined in the prediction of learning strategies is personality (e.g. Bidjerano & Dai, 2007), showing associations up to  $r = 0.56$  (Künsting & Lipowsky, 2011). Thus, even though personality seems to be a strong predictor of learning strategies, it leaves a lot of variance unaccounted for and calls for the identification of alternative predictors explaining incremental variance in students' learning strategies over and above the influence of personality. One variable of increasing interest is the chronotype, i.e. individual morningness/eveningness preferences, which usually show pronounced individual differences (Jovanovski & Bassili, 2007) and are considered as “non-traditional” and promising predictors of academic attainment” (Preckel et al., 2013, p. 115). The recently published Chronotype-Academic Performance Model by Roeser, Schlarb, and Kübler (2013) assumes that there is no direct effect of chronotype on academic success. It

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rather influences academic success through its effect on learning motivation which in turn influences success. Based on these assumptions, we investigated the relationship between chronotype and actual learning strategy use. However, since chronotype is not independent of personality (e.g., Tsaousis, 2010) it is essential to control for personality in order to determine the unique contribution of chronotype in the prediction of learning strategies.

### 1.1. Learning strategies and personality

Learning strategies are included in all recent theories of strategic and self-regulated learning (Weinstein, Acee, & Young, 2011). They have been defined as “behaviors and thoughts that a learner engages in during learning and that are intended to influence the learner’s encoding process” (Weinstein & Mayer, 1986, p. 315). Models of learning strategies have either integrated cognitive and motivational levels of learning or separate both aspects (cf. Wild & Schiefele, 1993). In the present study, we relied on a framework capitalizing on cognitive aspects (Measurement of Learning Strategies in Academic Studies, LIST; Wild & Schiefele, 1994) based on the taxonomy of the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1991). Both instruments differentiate between two classification levels: Higher-level cognitive, metacognitive, and resource-related strategies and lower-level structures assessed by the more specific subscales of the questionnaire (Wild & Schiefele, 1994). The methodological basis of the LIST, however, has been criticized because recent work did not confirm the proposed higher-order three-factor structure (Boerner, Seeber, Keller, & Beinborn, 2005). Instead, it was suggested that a two-factor model including the second-order factors “learning discipline” and “elaboration” may be more appropriate to account for the learning strategies assessed by the LIST (Blickle, 1996). In this model, the factor learning discipline is determined by strategies such as memorizing learning content through repetition or creating timetables, whereas strategies such as trying to link learning contents with previous knowledge or critically examining contents are represented by the factor elaboration. The finding of two factors ties in with Krapps’ (1993) conclusion in a research review that dimensional analyses in learning research often yield two-strategy clusters: Surface and deep-processing strategies, referring to either memorizing or intending to reach a deeper meaning of the learning content. Another important characteristic of learning strategies, especially compared to more stable constructs, such as general cognitive ability, is the fact that they are learnable and changeable (e.g., through trainings) (Bidjerano & Dai, 2007).

In contrast to learning strategies, personality traits are considered as “relatively enduring patterns of thoughts, feelings, and behaviors that distinguish individuals from one another” (Roberts, 2008, p. 31). The “Big Five” model of personality (McCrae & Costa, 1987) presents five major domains of personality: Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness (for a review of different personality models, see Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993). Associations with learning strategies are particularly found for the personality traits conscientiousness (e.g. Künsting & Lipowsky, 2011) as well as for openness (e.g. Bidjerano & Dai, 2007). Blickle (1996), for example, found the following pattern of results: Conscientiousness was correlated with the factor learning discipline and openness with the factor elaboration. Bidjerano and Dai (2007) concluded that learning strategies “co-vary with personality dimensions to a certain extent, implying that self-regulated learning, in general, might have personality underpinnings” (p. 77).

### 1.2. Chronotype, personality and learning strategies

The construct of chronotype refers to relatively stable individual differences in circadian orientation and reflects a preference for activities in the morning (“lark”) or evening (“owl”). Chronotype is typically assessed by self-report questionnaires which are either one-dimensional with the opposites eveningness and morningness or two-dimensional assessing morningness and eveningness on separate scales. Individual differences in circadian rhythms have been validated by physiological parameters (for an overview, see Adan et al., 2012) and are associated with different outcome variables, such as various aspects of personality (e.g., Cavallera, Gatto, & Boari, 2014; Randler, Baumann, & Horzum, 2014), creative thinking (Giampietro & Cavallera, 2007) as well as life habits and cognitive abilities (for an overview see Cavallera & Giudici, 2008). In particular, studies applying a one-dimensional conceptualization found that morningness is related to conscientiousness and agreeableness, whereas the other personality traits showed small but negative associations with morningness (for a meta-analysis, see Tsaousis, 2010). Contrary, Lipnevich, Credé, Roberts and Preckel (unpublished meta-analytic results, 2014) applied the two-dimensional framework of the chronotype and showed positive associations of morningness with conscientiousness, agreeableness, extraversion, and openness as well as negative correlations with neuroticism. Furthermore, eveningness was negatively associated with conscientiousness, agreeableness, and neuroticism, and positively with openness and extraversion.

Though several studies have reported significant relationships between chronotype and academic achievement (for a meta-analysis, see Preckel, Lipnevich, Schneider, & Roberts, 2011) the association between morningness/eveningness and learning strategies has not been investigated systematically. Furthermore, to our knowledge no prior study has controlled for personality traits in this relationship. This is particularly surprising because several studies have pointed to the influence of chronotype on learning-related constructs, such as learning motivation (Roesser et al., 2013), attention (Vollmer, Pötsch, & Randler, 2013), and online learning preferences (Jovanovski & Bassili, 2007). Furthermore, there are findings indicating a significant association between chronotype and learning approaches: Morning-type students showed lower surface learning scores, whereas evening-type students had lower deep learning approach scores in comparison to other chronotypes (Önder, Horzum, & Besoluk, 2012).

In summary, the present study pursued two major goals in an attempt to integrate the growing research interest in chronotype (Adan et al., 2012) and university students’ learning strategies (Bidjerano & Dai, 2007). First, we tested for associations between personality, chronotype, and learning strategies. Based on previous findings, we expected to find the strongest positive relations between learning discipline and conscientiousness as well as between elaboration and openness (cf. Blickle, 1996). In terms of personality and chronotype, we tested previous results from Lipnevich and colleagues (2014; Preckel, 2011) showing significant associations between chronotype and all personality traits. Specifically, morningness should be positively associated with all personality traits except for neuroticism, whereas eveningness is expected to correlate positively with openness and extraversion and negatively with the other personality traits. In contrast to previous studies that applied one-dimensional frameworks of chronotype (e.g., Önder et al., 2012), we tested for the first time for significant associations between morningness/eveningness and learning strategies. Secondly and most importantly, this is the first study investigating the predictive validity of chronotype for learning strategies while controlling for influences of personality and

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