

# Can students' dream experiences reflect their performance in public examinations?

Calvin Kai-Ching Yu

Hong Kong Shue Yan University, Department of Counselling and Psychology, Hong Kong

*Summary.* The hypothesis that the phenomenological intensity of dreaming can reflect academic performance was tested in this study. The sample contained 668 Hong Kong upper secondary school graduates, whose academic performance was measured by the results of two public examinations for the admission to local upper secondary schools and universities. Their dream intensity and personality traits were assessed using the Dream Intensity Scale, NEO Five-Factor Inventory, and Affective Neurosciences Personality Scales. The findings indicate that the subjective intensity of dreaming makes unique contributions to the prediction of examination grades that cannot be accounted for by sex, personality and emotional attributes, and former examination performance. Additionally, interindividual variations in dream experiences seem to be more sensitive to the performance in language subjects than to global academic performance.

*Keywords:* Academic performance, dream intensity, emotions, personality, public examinations

## 1. Introduction

Various theories have been proposed to explain the functions of dreaming, such as generating a virtual reality of the outer world (Hobson, 2009), threat simulation (Revonsuo, 2000; Valli & Revonsuo, 2009), mood regulation (e.g., Cartwright, Baehr, Kirkby, Pandi-Perumal, Kabat, 2003; Cartwright, Luten, Young, Mercer, & Bears, 1998; Cartwright, Young, Mercer, & Bears, 1998; Perlis & Nielsen, 1993; Yu, 2007b, 2015b), and memory consolidation (e.g., Cipolli, Fagioli, Mazzetti, & Tuoizzi, 2004; Murkar, Smith, Dale, & Miller, 2014; Payne & Nadel, 2004; Wamsley, Tucker, Payne, Benavides, & Stickgold, 2010). These theories have received some indirect empirical support. On account of the evidence that the intensities of both positive and negative emotions reached the peaks in the third and sixth REM-sleep episodes and as compared with the presleep emotions dropped significantly after sleep, for instance, Yu (2007b, 2015b) asserted that dreaming is a cathartic process. If the abovementioned theories are true, it follows that dream experiences may be in one way or another connected with academic performance. Specifically, emotional preoccupations over examinations during wakefulness are perhaps incorporated into the content of dreams at night for the purpose of fuelling the achievement motivation or desensitizing the examination anxiety by, for instance, rehearsing difficult examination situations. Furthermore, better examination performance could possibly be predicted by dream vividness provided that metaphorically revising for an examination in dreams somehow facilitates the consolidation of daytime learning. These notions are perhaps not so far-fetched when it is con-

sidered that imaginary techniques have long been applied in facilitating examination performance by rehearsing an examination situation in vivo and to cope with anxiety and distress associated with examinations (e.g., De Vos & Louw, 2006; Krippner, 1970; Palan & Chandwani, 1989; Ritzman, 1994; Sapp, 1991; Stanton, 1988; Wark, 2011; Woods, 1986; Yu, 2005, 2006).

Hong Kong is a very competitive society, where academic achievement is heavily emphasized. Students in Hong Kong are immensely motivated to excel in public examinations, which constitute the major factors that determine the admission into local upper secondary schools and universities. Although academic performance can be indicated by many factors and even includes students' participation in extra-curricular activities, public examination results are most likely what most secondary school students are concerned about. In connection with this, dreams involving "school, teachers, studying" and "failing an examination" are very common among students and have been considered as typical dream themes (Nielsen et al., 2003; Schredl, Ciric, Götz, & Wittmann, 2004; Yu, 2008a, 2009b, 2010b, 2011, 2012a). This is even truer for Hong Kong Chinese students: over 90% of students in Yu's (2008a, 2009b, 2010b, 2011, 2012a) studies reported having dreamed about "school, teachers, studying" as compared with 67.1% of Nielsen et al.'s (2003) Canadian sample and 89.2% of the German sample in the study by Schredl et al. (2004). Similarly, compared to the Canadian and German students, a higher proportion of the Chinese students had experienced "failing an examination" in their dreams (Chinese over 75%, Canadian 45.0% and German 60.8%). In addition to these two typical themes, Yu (2012a) also discovered other school-related themes that are also distinguished by their remarkable incidence, such as "being absent from classes or examinations" (50.3%).

In contrast to the ample evidence for the prevalence of school-related dreams, very limited findings concerning the relationship between the phenomenology of dreaming and the actual academic performance have hitherto been documented in the literature. An early study of dreams collected

Corresponding address:

Calvin Kai-Ching Yu, Department of Counselling and Psychology, Hong Kong Shue Yan University, 10 Wai Tsui Crescent, Braemar Hill Road, North Point, Hong Kong.  
Email: calvinkcyu@gmail.com

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from Nigerian high school students (Ekeh, 1972) found that marginal students were more likely than good or poorly performing students to report examination dreams. The author attributed the greater frequency of examination dreams among marginal students to their higher examination anxiety. This, however, remained only the author's speculation in that the students' anxiety level had not been measured. In a recent survey, Arnulf et al. (2014) collected dream reports from French students who sat for an examination that determined whether they could enter medical school. They showed that students with dream recall in the night prior to the examination performed better in the examination than did students without dream recall. Moreover, a higher examination grade was associated with dreaming about the examination in the preceding night and the frequency of examination dreams during the first term of the first university year. This occurred despite the finding that the precise content of dreams did not have any effects. Indeed, the authors highlighted the fact that 78% of the examination dreams reported by the students were negatively toned, for instance, being late for examination, difficulties answering the questions, and failing the examination. On the strength of their findings, Arnulf et al. put forth the argument that dreams can anticipate a stressful examination and that the pessimistic anticipation of a nerve-racking event in dreams may serve as a threat simulation, which optimizes daytime performance. This anticipatory nature of dreaming has also been touched on by other researchers, such as dreaming of athletic failures before an important competition (Erlacher, Ehrlenspiel, & Schredl, 2011).

The primary parameter that Arnulf et al. (2014) investigated was those anticipatory dreams featuring the examination the next day, which supposedly reflect a person's current emotional state. Yu (2008b, 2009a, 2010a, 2012b) postulated that dream experiences can indeed be conceived as a trait of consciousness – that is, a person's quality that should be more properly assessed by a group of dream variables than by a single, isolated dream episode. According to Yu's (2013a, 2013b) structural equation modeling analyses, the phenomenological properties of dreaming can be adequately assessed by two primary factors: dream intensity and dream content. Dream intensity, defined as the aggregate magnitude of sleep-state mentation, can be captured qualitatively by dream vividness and quantitatively by the frequencies of dream awareness, recalling the main content of dreams, nightmares, and intense dream episodes other than nightmares, such as lucid dreaming (Yu, 2008b, 2009a, 2010a, 2012b).

Academic performance is most probably the cumulative result of some long-term factors, including personal attributes and the efforts and time invested in learning and revision. If performance in an examination is related to the dream from the preceding night, it is reasonable to conjecture that dream variables that characterize a person also modulate the performance. Although Arnulf et al. quantified the frequencies of dream recall and examination dreams during the first term by a 5-level Likert item (never, sometimes, quite often, often, and very often), this sort of single-probe scales is far from adequate in profiling the multiplicity of nocturnal consciousness (Yu, 2008b, 2009a, 2010a, 2012b).

It has been known, furthermore, that Big Five personality traits, especially neuroticism and conscientiousness, are significant predictors of both dream experiences (e.g., Yu,

2010, 2012, 2013, 2013) and academic performance (e.g., De Feyter, Caers, & Vigna, 2012; Kappe & van der Flier, 2010; Komarraju, Karau, Schmeck, & Avdic, 2011; Neuen-schwander, Cimeli, Röhliberger, & Roebbers, 2013; Rosander & Bäckström, 2014; Rosander, Bäckström, & Stenberg, 2011; Steinmayr, Bipp, & Spinath, 2011; Trapmann, Hell, Hirn, & Schuler, 2007; Vedel, 2014). These personality dimensions still hold predictive values even after controlling the effects of other critical factors, such as general intelligence (Rosander et al., 2011), learning styles (Komarraju et al., 2011), and goal orientations (Trapmann et al., 2007). It is therefore important to assess personality traits in the study of the relationship between dreaming and academic performance so that their mediating effects can be factored into the prediction model. Arnulf et al., however, did not include personality factors in their analyses.

The study presented here was geared toward determining whether the phenomenological intensity of dreaming can predict public examination results even with personality traits being taken into account. To test this hypothesis, 668 Hong Kong secondary school graduates, who attended two major local examinations for upper secondary school and university admissions, were investigated. Unlike Arnulf et al.'s study, in which students' performance was measured using the results of a two-session medical school entrance examination, this study evaluated students' performance based on the examination results of a variety of subjects that most local secondary school students took, such as English, Chinese, Mathematics, History, and Physics. Moreover, in view of the evidence that female students tend to outperform male students in Hong Kong public examinations (e.g., Wong, Lam, & Ho, 2002; Yu, 2015a), sex was included in the analyses.

## 2. Method

### 2.1. Participants

The sample was made up of 225 (33.7%) male and 443 (66.3%) female participants, who took the Hong Kong Advanced Level Examination in the same year this study was conducted. The average age was 19.27 (range = 18-24, SD = 1.038). They were recruited during the university admission period and within three months after the examination. Confidentiality was assured and their consent was obtained prior to the session in which they completed a set of questionnaires and provided the official examination transcripts. By the time this study was conducted, Hong Kong students normally completed the lower secondary school in five years and completed the upper secondary school in two years.

### 2.2. Instruments

Subjective intensity of dream experiences was assessed using the Dream Intensity Scale (DIS – see below). Academic performance scores were computed based on the results of two public examinations that local upper secondary schools and universities employed to select students for admission. In addition to the measures of dream experiences and academic performance, the NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1985) was adopted to assess five primary personality dimensions: neuroticism, extraversion, openness-to-experience, agreeableness, and conscientiousness. The assessment of students' personality was supplemented by the Affective Neurosciences Per-

sonality Scales (ANPS; Davis, Panksepp, & Normansell, 2003) in view of the previous evidence that emotionality is an important factor for both academic performance and dreaming. The ANPS measures six affective traits: playfulness, seeking, caring, fear, anger, and sadness. All questionnaires were done manually on paper.

### 2.2.1 Dream Intensity Inventory (DIS)

The DIS (Yu, 2012b), which assesses the cognitive representation of the aggregate magnitude of sleep-state mentation by summarizing a wide range of dream-related activities over the past few years, is an elaborate version of the Dream Intensity Inventory (DII; 2008b, 2009a). It consists of 23 self-rating items; respondents indicate their frequencies of dream experiences on a standardized scale (e.g., 0 = never to 9 = almost every day). The 23 items can be divided into four main factors: Dream Quantity, Dream Vividness, Diffusion, and Altered Dream Episodes. The Dream Quantity scale comprises variables that measure the quantitative aspect of regular dream activities shared by most people, for example, the frequencies of dream awareness, recalling the main content of dreams, and nightmares. The Dream Vividness scale is made up of the Major Modalities and Minor Modalities subscales, which encompass variables concerned with sensory experiences during dreaming (e.g., hearing sounds, feeling emotions in dreams). The Diffusion scale comprises the Dream Work and Paramnesia subscales, both of which measure the cognitive distortion that entails the transference of psychical values (e.g., condensation, dream-reality confusion). The Altered Dream Episodes scale, which consists of the Lucid Dreaming and Autosuggestion subscales, assesses dream lucidity based on the incidence of altered forms of dream experiences (e.g., awareness of being in a dream, exerting control over dream content). The sum of the four factor scores yields a global intensity score. The psychometric properties of the DIS are available in Yu's (2008b, 2009a, 2010a, 2012b) previous reports. The latest version of the DIS can be found in Yu's (2012b) report.

### 2.2.2 Public Examination Results

Hong Kong Certificate of Education Examination (HKCEE) and Hong Kong Advanced Level Examination (HKALE)/Hong Kong Advanced Supplementary Level Examination (HKASLE) indicated participants' academic performance in the first five secondary school years and that in the recent two upper secondary school years, respectively. All examination grades were converted into points for the computation of performance scores (A = 5, B = 4, C = 3, D = 2, E = 1, and F = 0). Two total scores were calculated in accordance with the local admission requirements for upper secondary school and university studies:

1. HKCEE total score (Chinese Language + English Language + sum of the best four other subjects)
2. HKALE total score (Chinese Language and Culture + Use of English + one Advanced Level subject with the highest grade or 0.5 x sum of the best two Advanced Supplementary Level subjects)

Additionally, two language scores were computed in an attempt to test whether global academic performance and language performance have similar correlations with dream

Table 1. General Characteristics of the Sample (N = 668).

Variables	Mean	SD
DIS		
Global intensity	49.06	16.637
Dream quantity	21.91	7.717
Dream vividness	10.29	3.512
Diffusion	8.62	4.689
Altered dream episodes	8.34	6.410
NEO-FFI		
Neuroticism	18.21	7.859
Extraversion	31.91	6.457
Openness-to-experience	31.33	5.313
Agreeableness	32.37	5.292
Conscientiousness	33.98	5.755
ANPS		
Playfulness	41.94	4.761
Seeking	40.81	3.799
Caring	43.11	4.810
Fear	35.63	5.650
Anger	28.94	5.330
Sadness	33.34	4.499
Public examinations		
HKCEE total	15.39	2.985
HKALE total	5.27	1.488
HKCEE language	4.88	1.315
HKALE language	3.42	1.136

and personality variables:

1. HKCEE language score (Chinese Language + English Language)
2. HKALE language score (Chinese Language and Culture + Use of English)

### 2.3. Sample Characteristics

The mean values and standard deviations of the NEO-FFI, ANPS, DIS, and academic performance scores for the present sample are provided in Table 1.

### 2.4. Statistical Strategies

Stepwise regression analyses were performed using the Statistical Package for the Social Sciences. It was hypothesized that the DIS global intensity score could significantly predict the HKALE total and language scores even with participants' previous performance in the HKCEE, NEO-FFI personality traits, and ANPS affective attributes being taken into account. The associations of the four examination scores with the NEO-FFI, ANPS, and DIS scores were first examined by Spearman's rank correlations ( $r_s$ ); only significant correlates were entered into the regression analyses.

### 3. Results

The DIS global intensity score was positively correlated with the HKALE total score ( $r_s = 0.129, p < .01$ ), HKALE language score ( $r_s = 0.156, p < .001$ ), and HKCEE language score ( $r_s = 0.169, p < .001$ ). There was a moderate correlation between the HKALE and HKCEE total scores ( $r_s = 0.389, p < .001$ ). Both the HKALE total score and the HKALE language score significantly varied with the NEO-FFI neuroticism ( $r_s = 0.104, p < .01$ ;  $r_s = 0.117, p < .01$ ) and ANPS anger scores ( $r_s = 0.124, p < .01$ ;  $r_s = 0.129, p < .01$ ). There was also a trend that females had a larger HKALE total score than did males ( $z = 1.898, p = .058$ , Cohen's  $d = 0.174$ ). The HKALE total and language scores were weakly correlated with the ANPS fear ( $r_s = .083, p < .05$ ;  $r_s = .079, p < .05$ ) and sadness scores ( $r_s = .093, p < .05$ ;  $r_s = .085, p < .05$ ).

The curve estimation analyses indicated that the HKALE total score was significantly and linearly regressed onto all four major DIS scale scores, especially the Dream Quantity score ( $F = 13.683, p < .001, R^2 = .021, b = .028$ ; see Figure 1). A stepwise regression analysis was performed to test whether sex, the NEO-FFI neuroticism, ANPS anger, ANPS fear, ANPS sadness, DIS global intensity score, and the HKCEE total score could predict the HKALE total score. The resultant model ( $F = 51.967, p < .001, R^2 = .206$ ) included the HKCEE total score ( $t = 11.491, p < .001$ ), the DIS global intensity score ( $t = 2.763, p < .01$ ), and the ANPS anger score ( $t = 1.965, p < .05$ ), sex, the NEO-FFI neuroticism score, the ANPS fear score, and the ANPS sadness score being eliminated (see Table 2). Another regression analysis for the HKALE language score was carried out using sex, the NEO-FFI neuroticism, ANPS anger, ANPS fear, ANPS sadness, DIS global intensity score, and the HKCEE language score as predictors. A similar model ( $F = 82.14, p < .001, R^2 = .290$ ), which was composed of the HKCEE language score ( $t = 14.495, p < .001$ ), the ANPS anger ( $t = 3.131, p < .01$ ), and the DIS global intensity score ( $t = 1.969, p < .05$ ), was generated.

The correlations of the combined HKCEE and HKALE language score (HKCEE language score + HKALE lan-

Table 2. Standardized Coefficients ( $\beta$ ) of the Predictors Included in the Regression Models for the HKALE Total and Language Scores

Scales	HKALE total	HKALE language
Sex	c	c
NEO-FFI Neuroticism	c	c
ANPS Anger	.073	.109
ANPS Fear	c	c
ANPS Sadness	c	c
DIS Global intensity	.102	.070
HKCEE total	.420	
HKCEE language		.505

Note. c = significant correlates that were entered into but were eliminated by the regression analysis.

guage score) and individual subjects with dream variables were examined. The combined language score was significantly correlated with 11 of the 13 DIS scale and subscale scores, its correlations with the DIS global score ( $r_s = 0.181, p < .001$ ), Dream Quantity scale ( $r_s = 0.175, p < .001$ ), Regular Dream subscale ( $r_s = 0.172, p < .001$ ), and Lucid Dreaming subscale ( $r_s = 0.157, p < .001$ ) being relatively robust. Grades in HKCEE Physics varied in inverse proportion to scores on the DIS Diffusion scale ( $r_s = -0.117, p < .05$ ) and its Dream Work subscale ( $r_s = -0.155, p < .01$ ). Similarly, the HKALE Physics grade was negatively correlated with the Dream Work subscale score ( $r_s = -0.202, p < .05$ ). The other popular elective subjects – including Additional Mathematics, Biology, Chemistry, Physics, Chinese History, Economics, and Geography – did not exhibit any association with any dream scales.

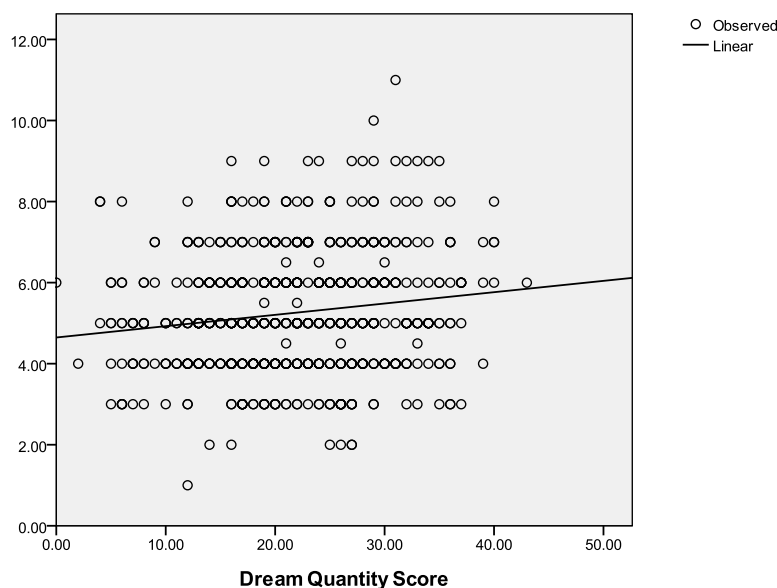


Figure 1. Linear Curve Estimation for the HKALE Total Score

#### 4. Discussion

Arnulf et al. (2014) found that students with dream recall during the night prior to a medical school entrance examination obtained a better average grade in the examination than did students without dream recall. The average grade was even higher for those students who actually dreamed of the examination, although the exact content of the examination dream did not have significant effects. Along this line of findings, the study presented here demonstrated that dream experiences as a trait of consciousness that characterizes a person – that is, general dream intensity as measured by the DIS global score – can positively predict public examination results. Accordingly, it is perhaps the nocturnal consciousness attributes of a person, rather than the presence or absence of dream recall in a single night, that reflect daytime academic performance. This extrapolation resonates with the assumption that performance is more akin to continuing, stable factors.

In addition, the DIS score still held predictive values for the HKALE total score and the HKALE language score even after taking into consideration the effects of sex, personality traits, emotional attributes, and preceding performance in the HKCEE. In other words, the phenomenological experience of dreaming made unique contributions to the prediction of examination grades that cannot be accounted for by these critical factors. Although Big Five personality traits are known to be significant correlates of both dream experiences and academic performance, they do not appear to mediate the relationship between dream characteristics and public examination results. The result that public examination results were more related to the DIS score than to the NEO-FFI personality traits might indeed highlight the importance of the role played by nocturnal conscious activities in the psychology of daytime performance.

Somehow inconsistent with well-established evidence, the correlation between conscientiousness and academic performance was not significant in the current study. This can be explained by the diversity of the criteria and measures of academic performance adopted by different researchers. It is a widespread practice for researchers to recruit psychology students and correlate their Grade Point Average (GPA) with personality factors. In Arnulf et al.'s study, university students' performance was measured using the results of a two-session medical school entrance examination. As Vedel's (2014) meta-analysis pointed out, the university major significantly moderates the relationship between conscientiousness and GPA. Unlike many previous studies, which tapped into students' performance in a specific discipline, the current study assessed performance based on the examination results of a variety of subjects that most Hong Kong secondary school students would take.

A comparison of the correlation coefficients seems to suggest that dream intensity is more related to language performance than to general academic performance. In contrast to the positive associations of dream intensity with language performance and general academic performance, furthermore, performance in physics seems to have an inversely relationship with dream distortion. Language acquisition is different from learning other subjects in that it entails procedural memory (Ferman, Olshtain, Schechtman, & Karni, 2009; Morgan-Short, Faretta-Stutenberg, & Brill-Schuetz, 2014; Ullman, 2013). Fronto-basal-ganglia structures, where procedural memory and grammatical rules and sequences are localized (Ullman, 2001, 2004, 2013), also constitute an essential neural circuit for the instigation of dream activities (Yu, 2001, 2003, 2007a). In light of the present findings, the varying role of dreaming in different

Table 3. z-scores of the Mann-Whitney U Test Differences in the HKCEE and HKALE Scores between Participants with Sleep Problems and Participants without Sleep Problems (N = 611)

	HKCEE Scores		HKALE Scores	
	Total	Language	Total	Language
Any sleep problems	.786	.778	1.073	.285
Dyssomnias				
Sleep onset insomnia	.751	1.380	.584	.251
Late insomnia	.570	1.387	.180	.724
Hypersomnia	.425	1.895	.290	.548
Sleep paralysis	.545	1.294	.100	.508
Snoring	.125	1.208	1.312	2.094 <sup>a</sup>
Sleep-related respiratory pauses	.281	.513	.268	.524
Disrupted circadian rhythm	.962	.705	1.903	.905
Parasomnias				
Sleep terror	.312	.027	.382	.199
Sleep bruxism	.248	.815	.257	.514
Restless, jerking, painful legs	.319	.570	.564	.193
Sleeptalking	.735	1.005	2.153 <sup>b</sup>	1.651

Note. <sup>a</sup> Snorers (M = 3.00) had a smaller average HKALE language score than did non-snorers (M = 3.31),  $z = 2.094$ ,  $p < .05$ , Cohen's  $d = -0.302$ .

<sup>b</sup> Compared with non-sleeptalkers (M = 5.02), sleeptalkers had a smaller average HKALE total score (M = 4.69),  $z = 2.153$ ,  $p < .05$ , Cohen's  $d = -0.238$ .

types of learning warrants further investigation.

The present sample contained more female than male students. This uneven sex ratio can be in part accounted for by the fact that more female than male students in Hong Kong are able to enter upper secondary schools. Another limitation is concerned with participants' sleep quality. Since virtually all sleep problems were found to have no significant effects on public examination scores in my other similar sample of examination candidates (Male = 219, Female = 392; see Table 3), I have not assessed participants' sleep habit in the study presented here. Nonetheless, as shown by many studies (e.g., Ahrberg, Dresler, Niedermaier, Steiger, & Genzel, 2012; Becker, Adams, & Orr, 2008; Chang, Arendt, Zheng, & Hanisch, 2014; Genzel et al., 2013; Gilbert & Weaver, 2010; Mirghani, Mohammed, Almutadha, & Ahmed, 2015; Short, Gradisar, Lack, & Wright, 2013; Tonetti, Fabbri, Filardi, Martoni, & Natale, 2015), sleep quality probably still have impacts on academic performance measured by other methods, such as GPA.

The DIS scores were significantly related to the public examination scores, yet the effect sizes being small. This is not unexpected because dreaming is presumably merely one of the numerous factors associated with examination performance, including, apparently, a person's intellectual ability and attitude toward examinations. Moreover, the DIS measures the phenomenological intensity of dreaming by quantifying respondents' subjective dream experiences; it is almost certain that as with all other retrospective measures, the DIS scores are likely to underestimate the actual occurrence of sleep mentation (Yu, 2014, 2015b). Future studies might be undertaken to explore whether dreams obtained with a diary or at a sleep laboratory would similarly reflect examination performance and how sleep quality and the examination type moderate the relationship.

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