Pharmaceutical cognitive enhancement in Greek university students: differences between users and non-users in social cognitive variables, burnout and engagement

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Pharmaceutical cognitive enhancement (PCE) represents the non-medical use of prescribed medication for the improvement of cognitive functioning and academic performance. Although there are some studies about PCE prevalence, it is less clear how users and non-users of PCE substances differ with respect to their positive and negative student experiences (e.g., academic burnout, engagement with studies) and in social cognitive variables that relate to decision-making and self-regulation of PCE use. The present study assessed whether students with different experiences of PCE substance use displayed differences in academic burnout, study engagement and social cognitive variables relevant to PCE use. Three hundred and forty seven University students (*M* age = 22.15, *SD* = 1.69; 54% females) completed a battery of anonymous questionnaires on academic burnout, engagement with studies, social cognitive variables relevant to PCE use, and self-reported use of PCE substances and non-prescribed nutritional supplements. Three user groups emerged, namely, non-users (51.9%, *n* = 180), single users of non-prescribed dietary supplements (25.4%, *n* = 88), and dual users of both non-prescribed dietary supplements and PCE (22.8%, *n* = 79). Multivariate analysis of variance indicated significant differences among the three user groups in intentions, attitudes, social norms, and anticipated regret towards PCE use. No significant differences were observed with respect to academic burnout and work engagement. The findings show that University students may engage in PCE use independently of their student experiences. Rather, a chemically-assisted performance enhancement mindset seems to differentiate users from non-users of PCE substances.

Keywords: pharmaceutical cognitive enhancement; academic burnout; engagement; social cognition

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Introduction

Pharmaceutical cognitive enhancement (PCE) represents the non-medical use of prescription medication for the improvement of cognitive functions (e.g., memory, alertness, mental focus) and subsequent academic performance among University students (Maier, Liechti, Herzig, & Schaub, 2013). The use of PCE has followed the developments in neuroscience about the use of certain drugs to improve the cognitive, emotional and even motivational states and brain processes of healthy individuals who do not suffer by mental illnesses or related disorders (Lucke, Bell, Partridge, & Hall, 2011; Repantis, Schlattmann, Laisney, & Heuser, 2010). PCE is also known as "neuroenhancement", "cognitive enhancement medication", and "smart drug" use (Castaldi et al., 2012; Hildt, Lied, & Günter Franke, 2014). Some scholars have also used the term 'academic doping' to parallel PCE with the misuse of prescribed drugs in sports and exercise settings for the improvement of athletic performance and/or physical appearance (e.g., Wolff & Brand, 2013). Recent evidence shows that PCE use among University students can range from 13% to 25% in different countries, and is expected to increase further over the next years (Lucke et al., 2011; Maier et al., 2013). While the proponents of PCE use argue that this practice can benefit healthy individuals (including students), who want to improve their mental capacities and cognitive functions (e.g., Greely et al., 2008), still, others appear to be more sceptical about the actual benefits of PCE and denote that popular media tend to misrepresent PCE as highly popular and effective despite the weak empirical support for such claims (Partridge, Bell, Lucke, Yeates, & Hall, 2011). Either way, PCE reflects the misuse of prescribed medicines and, until it is regulated, it merits further research attention especially in relation to the reasons, motivations and social situations/contexts that enable PCE use.

Academic burnout and engagement as correlates of PCE use

Using a behavioural science perspective can help in better understanding PCE use and accordingly inform relevant policies, regulations and preventive or harm-reduction interventions. Research in this area has only recently developed and the available evidence shows that University students view PCE as a way to gain a competitive advantage and perform better in their studies, as well as a way of coping with study demands (Partridge, Bell, Lucke, & Hall, 2013). The positive association between high study demands, psychological distress and self-reported PCE among University students has been empirically supported by several studies (e.g., Weyandt et al., 2009; Wolff & Brand, 2013). Another study among German University students found that self-reported PCE was associated with higher burnout scores (Wolff, Brand, Baumgarten, Lösel, & Ziegler, 2014). Taken together, these findings suggest that PCE can be seen as a way of coping with high demands and stress and, therefore, can be seen as a means-to-an-end (i.e., self-administering PCE to cope better with study demands).

Nonetheless, while these studies have addressed negative student experiences (i.e., studies-related stress and burnout) in relation to PCE use, they have paid less attention to positive experiences, such as engagement with studies. Schaufeli, Martinez, Pinto, Salanova, and Bakker (2002) defined engagement as the opposite of burnout and as a "positive, fulfilling, and work-related state of mind that is characterized by vigour, dedication and absorption" (p. 465). By this definition, vigour reflects high levels of energy and resilience, as well as the willingness to commit to the work at hand; dedication reflects commitment, sense of fulfilment and enthusiasm, and absorption reflects the sense of 'flow' (Csikszentmihalyi, 1990), whereby people become absorbed by the task/work at hand (González-Romá, Schaufeli, Bakker, & Lloret, 2006). Although engagement was primarily studied in relation to workplace stress and burnout several studies have shown that this

concept also applies to University students (Schaufeli, Salanova, González-Romá, & Bakker, 2002). If academic burnout is positively associated with PCE use (e.g., Wolff et al., 2014) and engagement with studies represents a positive student experience that is antithetical to academic burnout, then, it is sensible to expect that engagement with studies will be negatively associated with PCE use among University students. This hypothesis, however, remains to be determined by empirical evidence.

A social cognitive perspective of PCE use

An alternative explanation of PCE use among University students is that PCE is not directly relevant to situational demands (e.g., high academic stress) or the need to improve cognitive functions, but, rather, is associated with drug use-related traits and individual differences in reasoning patterns. That is, instead of assuming that PCE substances can be used by any student found in a demanding situation during his/her course of studies, it is possible that students with certain personality traits or mindsets would resort to the use of PCE, independently of whether they face high or low demands in their studies. In support of this hypothesis, Maier et al. (2015) compared PCE users and non-users and found that the former group displayed greater trait impulsivity, novelty seeking and Machiavellianism; that is, personality characteristics that have been associated with other forms of illicit drug use (e.g., Belin et al., 2008; de Wit, 2009; Howard et al., 2008).

Besides personality traits, PCE use can be differentially associated with social cognitive variables that are relevant to the decision-making processes underlying the behaviour in question, such as attitudes. Lucke (2012) emphasized the importance of attitudes research in better understanding PCE use and accordingly reframing public debates and informing policy-making about neuroenhancement practices. Accordingly, Zelli, Lucidi and Mallia (2016) argued that a social cognitive perspective is much needed in the psychological

study of PCE, especially in relation to University students' attitudes towards PCE, self-efficacy to engage in PCE, and prospective intentions to use PCE substances. This perspective will allow a better understanding of the decision-making and self-regulatory processes that underlie PCE use. The theory of planned behaviour (Ajzen, 1991) and more recent developments of this theory (e.g., the Integrative Model; Fishbein, 2009) represent the "reasoned action approach", and have been widely applied to the study of substance use across domains, cultures and age groups (Fishbein, 2009; Montano & Kasprzyk, 2015). These theories largely correspond to the propositions made by Zelli et al. (2016) about the need to incorporate a social cognitive perspective in the study of PCE. They also emphasize the roles of attitudes (e.g., positive or negative evaluations of PCE use), social norms (e.g., perceived social approval and perceived prevalence/popularity of PCE use in referent social groups), and self-efficacy beliefs (e.g., self-perceptions of the capability to access and use PCE if needed) in predicting intentions to enact a specific behaviour. More recent advances in social cognitive theory and research also emphasized the role of affective processes (e.g., anticipated regret from enacting or not enacting a given behaviour) and suggested that relevant constructs should be incorporated in studies of decision-making and intention-formation processes, especially in the domain of substance use and health-risk behaviours (e.g., Sandberg & Conner, 2008).

Zelli et al. (2016) further argued that this social cognitive perspective has been already used successfully in a distinct but conceptually similar field of research: the psychological study of doping use in sport and exercise settings. There is good reason to assume that the social cognitive processes that explain the misuse of prescribed medication for performance enhancement in sports and exercise may underlie (at least partly) the use of prescribed medication for the enhancement of academic performance in a University setting (Brand & Koch, 2016; Zelli et al., 2016). For instance, Barkoukis, Lazuras, Lucidi, and

Tsorbatzoudis (2015) found that users of dietary supplements for athletic performance enhancement, and users of doping substances (e.g., anabolic steroids) help more favourable attitudes towards doping and reported stronger intentions to use doping in the near future, as compared to non-users of such substances. Possibly, PCE users may differ from non-users in their attitudes, intentions and other social cognitive variables relevant to PCE use. Castaldi et al. (2012) showed that non-users perceived PCE substances as less risky than users. Accordingly, using the theory of planned behaviour, Judson and Langdon (2009) showed that users of prescription stimulants reported significantly more positive attitudes, less behavioural control, and more favourable social norms towards stimulant use as compared to non-users.

The present study

So far, research on PCE use among University students has described prevalence trends and user characteristics, and relevant behavioural science studies have been largely concerned with the associations between PCE use and situational characteristics and negative student experiences, such as high demands, stress and burnout (Weyandt et al., 2009; Wolff et al., 2014). Limited research also highlighted that PCE users may differ from non-users in their beliefs and intentions towards PCE use (e.g., Judson & Langdon, 2009). Although these studies have provided useful empirical insights, the study of PCE use keeps growing and there is a need to further extend the existing evidence base in theoretically relevant and meaningful ways. In doing so, it is important to consider the role of 'engagement with studies' because this variable represents the antithetical notion of burnout, and, hence should be negatively associated with PCE use and intentions (i.e., student with higher engagement should be less likely to be involved in PCE use). Therefore, the first aim of the present study was to assess if PCE users and non-users differed in the level they engaged with their studies, and it was hypothesized that PCE users will display higher burnout and lower engagement

scores as compared to non-users of PCE substances. Furthermore, PCE use may not only represent differences in burnout and engagement, but rather reflect individual differences in reasoning patterns as they are indicated by social cognitive variables (e.g., attitudes, social norms, self-efficacy beliefs, and anticipated regret). Thus, the second aim of the present study was to directly compare PCE users and non-users in their attitudes, social norms, self-efficacy beliefs, anticipated regret, and intentions towards using PCE substances. It was hypothesized that compared to non-users, PCE users will report significantly more positive attitudes towards PCE, more favourable social norms, less control over their PCE use, less anticipated regret from using PCE substances, and stronger PCE use intentions. Our study was concerned only with the non-medical use of prescribed medication (PCE substances).

Methods

Participants

Overall, 450 University students from state and private higher education institutions in Greece were approached and 347 agreed to take part in the study (77.1% response rate). Average (mean) age was 22.15 years (SD = 2.69), and 54% (*n* = 182) were females. With respect to field of studies, 31.3% (*n* = 79) studied in the medical and pharmaceutical school, 26.9% (*n* = 68) in the allied health professions school, 17.8% (*n* = 45) were in social sciences, 17% (*n* = 43) came from psychology, and 7.1% (*n* = 18) studied in computer science. Ninety four (27.1%) participants did not declare their field of studies. Ethics approval for the study was granted by the respective committee of the International Faculty of the University of Sheffield.

Measures

A battery of structured questionnaires was used to assess demographics (age/gender), PCE-specific social cognitive variables (attitudes, social norms, perceived behavioural

control/PBC, and anticipated regret), intentions to use PCE substances, academic burnout, engagement with studies, and past PCE use. To ensure that all participants completed the questionnaire with a common understanding of neuroenhancement, we provided the following definition in the first page of the survey "Neuroenhancement is defined as the use of prescribed medication without any medical cause or diagnosis with the goal to enhance academic performance (e.g., study for long hours without feeling tired and mentally exhausted, maintaining focus on reading and writing for long periods of time). Some of the most common medication used for neuroenhancement purposes include modafinil (e.g., Aspendos, Modiodal), and methylphenidate (Ritalin)". All the social cognitive variables presented below were assessed with respect to this definition.

Attitudes towards PCE were assessed with the mean score of responses in 5 semantic differential pairs of evaluative adjectives (i.e., "Using PCE substances to enhance my academic performance would be: harmful/beneficial; bad choice/good choice; useless/useful; stupid choice/smart choice; unhealthy/healthy"), and higher scores indicated more positive attitudes towards PCE. Internal consistency reliability was high (Cronbach's $\alpha = 0.91$).

Social norms were assessed with respect to both subjective/injunctive norms (i.e., perceived social approval of PCE by important others) and descriptive norms (i.e., perceived prevalence/frequency of PCE in referent groups). Subjective/injunctive norms were assessed with the mean score of five items (e.g., "Most people who are important to me would think that I should NOT use neuroenhancement substances", and "My close friends would NOT want me to use neuroenhancement substances"). Responses were recorded on a 6-point continuous scale (1 = definitely not, 6 = definitely yes), higher scores indicated greater social disapproval of PCE, and internal consistency reliability was high (Cronbach's $\alpha = 0.91$). Descriptive norms were measured with three single items. Two items respectively assessed the perceived prevalence (e.g., "Out of 100%, how many…do you think use PCE

substances") of PCE in students in the respondent's cohort, and among lecturers/teaching staff. Respondents were asked to give a prevalence estimate (percentage) from 0% to 100%. A single item assessed the perceived prevalence of PCE among students at the respondents' University/HE institution (i.e., " How many students in your University do you know (or have heard) that use/have used PCE substances at least once during their studies to improve their academic performance?"). Responses to this item were recorded on a 5-point continuous scale (from 1 = nobody, to 5 = a lot of them).

Perceived behavioural control (PBC) was assessed with the mean of three items reflecting the volitional control over using PCE substances (i.e., "I think that I completely control if I will use neuroenhancement substances to improve my academic performance", and "I am capable of controlling if I will use neuroenhancement substances to improve my academic performance"). Responses were recorded on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) higher scores indicated greater PBC, and internal consistency reliability was at acceptable levels (Cronbach's $\alpha = 0.75$).

Anticipated regret was assessed with the mean of four items reflecting anticipated negative affective responses from using PCE substances (e.g., "If I used neuroenhancement substances to improve my academic performance, I would feel disappointed with myself", and "If I used neuroenhancement substances to improve my academic performance, I would feel bad with myself"). Responses were recorded on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), higher scores indicated greater anticipated regret and internal consistency reliability was high (Cronbach's $\alpha = 0.89$).

Intentions to use PCE substances were assessed with the mean of four items (e.g., "Do you plan to use neuroenhancement substances to improve your academic performance in the next 6 months?" and "Will you use neuroenhancement substances to improve your academic

performance in the next 6 months?"). Responses were recorded on a 7-point continuous scale (1 = definitely not, 7 = definitely yes), higher scores indicated stronger intentions to use PCE substances and internal consistency reliability was very high (Cronbach's α = 0.93).

Academic burnout was assessed with the respective measure by Schaufeli et al. (2002), which is an adapted version of the Maslach Burnout Inventory for students (MBI-SS), and consists of 15 items reflecting the main dimensions of burnout: emotional exhaustion, cynicism, and efficacy. Responses were recorded on a 7-point frequency scale (0 = never, 6 = always). Responses in the efficacy items were reverse scored and higher scores in the MBI-SS reflected higher burnout. Mean scores were computed for each burnout dimension and internal consistency reliability was high (Exhaustion Cronbach's α = 0.81; Cynicism Cronbach's α = 0.88; Efficacy Cronbach's α = 0.77).

Engagement was assessed with the respective measure by Schaufeli et al. (2002) and consisted of 14 items respectively assessing vigour (5 items, e.g., "When I'm studying, I feel mentally strong"), dedication (5 items, e.g., "I find my studies to be full of meaning and purpose"), and absorption (4 items, e.g., "Time flies when I'm studying"). Mean scores were computed for each engagement dimension and internal consistency reliability was high (Vigour Cronbach's α = 0.85; Dedication Cronbach's α = 0.90; Absorption Cronbach's α = 0.80).

Past use of PCE substances with the question "Have you ever used PCE substances to improve your academic performance?" and yes/no response options were provided. For those who responded positively in this item, a follow up question was provided "If you ever used/currently use prescribed medicines for neuroenhancement, which ones did you use?" and four response options were given describing the most common PCE substances (i.e., Aspendos or Modiodal (modafinil), and Ritalin (methylphenidate)). An open-ended option

was also given in case a different PCE substance from those listed in the responses was used. Participants were allowed to select more than one response. Finally, a different question was used to assess past/current use of dietary supplements that allegedly have cognitive enhancement properties ("If you ever used/currently use dietary supplements that do not require medical prescription for neuroenhancement, which ones did you use?"), and responses included royal jelly, ginseng, vitamin C supplements, taurine, caffeine, vitamin B complex, spirulina, and coenzyme Q10. An open-ended option was also given in case a different supplement from the ones listed was used. Participants were allowed to select more than one response.

Design/Procedure

This is a survey-based correlational design and a cross-sectional, independent groups quasi-experimental design based on the three groups that were determined from the survey questions; supplement users only, non-users and dual users using PCE and supplements. Participants were approached in University settings (e.g., Library, Information Commons) by a research assistant and were asked to take part in a survey about University student's beliefs towards PCE. No time limits were imposed and survey completion lasted approximately 10 minutes. Following the guidelines of the British Psychological Society's Code of Human Research Ethics, all participants were properly informed about the purposes of the study and their participation rights (e.g., voluntary participation, right to withdraw at any point without prior notice), and ensured about the anonymity and confidentiality of their responses.

Statistical analysis

Three one-way multivariate analyses of variance (MANOVA) were used to explore differences between user groups. The selection of multivariate analysis was done to reduce pairwise error using multiple ANOVA's. We explored each assumption for conducting

MANOVA with great caution to ensure that this analysis was suitable for our data. Taking into account the linearity assumption (i.e., linear relationship between the dependent variables) we conducted three MAVONAs respectively; one for the socio-cognitive variables (attitudes, subjective and descriptive norms, PBC, and anticipated regret), one for the three dimensions of academic burnout (exhaustion, cynicism, and efficacy), and one for the three dimensions of study engagement (vigour, dedication, and absorption). Among the social cognitive variables, PBC did not correlate significantly with other variables and was excluded from the analysis. The correlations in all other dependent variables were moderate (see Table 1) therefore, there was low risk of multicollinearity. We also tested for multivariate outliers using the Mahalanobis distance that allowed for detection of outliers in our user groups. From the total sample of 347 participants we identified 8 cases that were multivariate outliers ($p<0.01$), which were effectively removed from the dataset. In similar fashion we identified 14 cases of multivariate outliers for the three dimensions of burnout, and another 3 cases for study engagement.

Bivariate correlation analysis (Pearson's r) was used to assess the correlations between social cognitive variables, burnout, engagement and intentions to use PCE substances. Analysis of frequencies with chi-square (χ^2) was used to assess the association between the use of dietary supplements and PCE substances.

Results

Descriptive statistics

The mean scores, standard deviations and inter-correlations (Pearson's r) among the study variables are presented in Table 1.

Self-reported use of dietary supplements and PCE substances

Analysis of frequencies showed that 21.5% (n = 73) students reported that they had used PCE substances, and 47.8% said they had previously used nutritional supplements for neuroenhancement purposes. Among the PCE medication users, the most commonly reported PCE substances were modafinil/Aspendos or Modiodal (15.1%) and methylphenidate/Ritalin (9.6%).

We run further analysis in order to identify groups of users who self-reported single use of PCE substances or nutritional supplements for neuroenhancement, and those who reported dual use of PCE and nutritional supplements. The following groups emerged: *non-users* (52.2%, n = 177), that is students who did not report having used neither dietary supplements for CE purposes, nor PCE medication; *dietary supplement users* (26.3%, n = 89), that is students who reported they have only used dietary supplements for CE purposes; and *dual users* (21.5%, n = 73), that is students who self-reported concurrent use of dietary supplements and PCE substances. There were no single users of PCE substances. Rather, participants who reported PCE substance use also reported having used nutritional supplements for neuroenhancement purposes.

Among dietary supplement users, 61.6% were poly-users, meaning that they reported consuming (or having consumed) more than one dietary supplements for CE purposes. Accordingly, among dual users, 80.5% were poly-users of dietary supplements.

Association between dietary supplement use and PCE substance use

Analysis of frequencies with chi-square (χ^2) showed that having used dietary supplements with alleged CE properties was significantly associated with self-reported past use of PCE substances ($\chi^2 = 112.06$, $p < .001$).

Differences between user groups

We conducted three one-way MANOVA's to examine group differences in social cognitive variables (attitudes, subjective and descriptive norms and anticipated regret), the three dimensions of burnout and the three dimensions of engagement. Our results indicated significant differences between non-users, dietary supplement users, and dual users in all the social cognitive variables that were included in the analysis (means and SDs are presented in Table 2). In all post-hoc analysis we used Bonferroni adjustment setting the significance level at $\alpha = 0.016$. Specifically, user groups differed in attitudes [F (2, 327) = 30.15, $p = 0.001$, $\eta_p^2 = 0.15$], with non-users exhibiting more negative attitudes towards PCE use as compared to both dietary supplement users ($p < 0.001$) and dual users ($p < 0.001$). There were statistically significant differences in intentions to use PCE substances [F (2, 327) = 88.54, $p = 0.001$, $\eta_p^2 = 0.35$], with non-users exhibiting weaker intentions to use PCE substances compared to both dietary supplement users ($p < 0.001$) and dual users ($p < 0.001$). Similarly, there were statistically significant differences in subjective norms towards PCE substances [F (2, 327) = 13.38, $p = 0.001$, $\eta_p^2 = 0.076$], with non-users reporting less perceived social approval of PCE use compared to both dietary supplement users ($p < 0.001$) and dual users ($p < 0.001$). In contrast, there were no differences in the perceptions of social approval between dietary supplement users and dual users. There was a significant effect for descriptive norms in terms of perceived prevalence of PCE use in other University students [F (2, 327) = 9.50, $p = 0.001$, $\eta_p^2 = 0.055$] and perceived prevalence of PCE use among academics [F (2, 327) = 7.71, $p = 0.001$, $\eta_p^2 = 0.045$]. In both cases the observed differences were significant only between non-users and dual users ($p<0.01$). Finally, there was a significant effect of user group on anticipated regret [F (2, 327) = 23.92, $p = 0.001$, $\eta_p^2 = 0.12$], with non-users reporting higher scores in anticipated regret compared to dietary supplement users ($p < 0.001$) and dual users ($p < 0.001$). There were no significant differences between the three user groups in the dimensions of academic burnout and study engagement.

Discussion

The present study directly compared University student users and non-users of PCE substances with respect to academic burnout, engagement with studies, and a range of PCE-relevant social cognitive variables (attitudes, social norms, self-efficacy beliefs, anticipated regret and behavioural intentions). Interestingly, three groups emerged: non-users, users of dietary supplements for cognitive enhancement purposes, and duals users (i.e., users of both dietary supplements and PCE substances). Our study showed that the non-medical use of PCE substances among Greek university students is rather high (>20%), compared to other European countries (for a review about the prevalence of PCE in Europe see Maier & Schaub, 2015). One reason for this high prevalence can be that the misuse and overuse of prescribed medication (e.g., misusing or overusing antibiotics without medical prescription) is rather common in Greece (e.g., Plachouras et al., 2010; Skliros et al., 2010). Another reason is that we did not control for pharmacological use of PCE substances, therefore, some of the respondents may have been using PCE for medical reasons. Nevertheless, this possibility could be ruled out because the questions about self-reported PCE use in the present study explicitly referred to non-medical use of PCE substances for the sole purpose of improving academic performance.

Based on previous research (e.g., Wollf et al., 2014) it was hypothesized that PCE users would report higher academic burnout scores, as compared to non-users; thus, implying that burnout is a risk factor for PCE use. Accordingly, study engagement represents the opposite of academic burnout (e.g., Schaufeli et al., 2002) and it was further hypothesized that PCE users will report significantly lower engagement scores than non-users; thus, implying that engagement can act protectively against PCE use. Nevertheless, the results of the present study showed that there were no differences in burnout and engagement scores between the three non-user/user groups. These findings challenge the notion that negative

student experiences, such as higher stress-related demands and burnout can lead to PCE use (e.g., Weyandt et al., 2009; Wollf et al., 2015), and also fail to support the hypothesis about the negative association between study engagement and self-reported PCE use. As Maier et al. (2015) argued PCE use may not necessarily represent differences in experiences (e.g., burnout) or situational factors, such as high demands, but rather individual differences in behavioural traits or personality.

In addition, the present study directly compared users and non-users of PCE and sought for differences in social cognitive variables assumed to underlie decision-making and intention formation processes. To this end, it was hypothesized that PCE users will report more favourable belies and intentions towards PCE use as compared to non-users. The results largely supported this hypothesis. In particular, as compared to both dietary supplement and dual users, non-users reported significantly weaker prospective intentions to use PCE substances, more negative attitudes towards PCE use, less perceived social approval and perceived prevalence of PCE use, and anticipated more regret from using PCE substances. These results are similar to Judson and Langdon (2009) and suggest that in as much the same way PCE users differ from non-users in their personality traits (e.g., Maier et al., 2015), they may also differ in their reasoning and decision-making patterns that are indicated by social cognitive variables, such as attitudes, self-efficacy, intentions and anticipated affective responses. Our results corroborate the findings from a recent qualitative study among British university students, which found that users of PCE substances, such as modafinil, saw PCE as a means for improving their academic performance and "catching up" with the performance of high achieving students. The same study also reported that PCE users thought of extending the use of PCE substances after the University years as a performance enhancement method in the workplace. Future research should address whether such achievement motivations

underlie the decision-making processes to use PCE substances among university students, as well as among employees.

Furthermore, an unexpected, yet alarming finding of the present study was that dietary supplement users did not differ from dual users (i.e., students using both PCE prescribed substances and non-prescribed dietary supplements) in attitudes, perceived social approval, and perceived prevalence of PCE use. This is an important finding because it implies that users of legal, non-prescribed dietary supplements may share common beliefs with PCE users about PCE use. This finding is similar to the results of the literature review conducted by Schelle, Faulmuller, Caviola and Hewstone (2014), where users and non-users of PCE held different concerns and attitudes towards PCE use. Also, very similar findings have been reported in the doping literature (e.g., Barkoukis et al., 2015) where the users of legal dietary supplements did not differ from users of prohibited doping substances in a range of social cognitive variables relevant to doping use. Although refraining from a discussion of a potential 'gateway' hypothesis, the present findings suggest that it should be further examined how and why users of dietary supplements display the same reasoning patterns with PCE users about PCE substance use (i.e., both groups viewed PCE substance use more positively, and as more socially acceptable and popular, compared to non-users). As Petroczi (2013) have argued, the use of (still) legal and non-prescribed medication for performance enhancement purposes may facilitate a mentality (or mindset) towards chemically-assisted performance enhancement, making it easier for the users of legal dietary supplements to make the leap towards the "dark side" of performance enhancement.

Our understanding of the differences and similarities between the three groups of PCE users/non-users would be markedly improved by a consideration of individual differences (e.g., Meier et al., 2015). The integrative model of behavioural prediction (Fishbein, 2009) posits that individual differences influence intention formation and actual behaviour through

attitudes, social norms and self-efficacy beliefs. To this end, the differences in social cognitive variables observed in the present study can be partly attributed to differences in personality traits, such as trait impulsivity, which has been associated with drug use and PCE use in the past (Meier et al., 2015; de Wite, 2009). Future studies should further address how individual differences in personality traits or other aspects of behaviour (e.g., motivation, achievement goals) relate to social cognitive beliefs about PCE use, and how the associations among these variables differ between groups with different PCE experiences.

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Table 1.

Mean scores, standard deviations and intercorrelations among the study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. PCE use intentions	-	.69*	-.33*	.34*	.31*	.37*	-.07	-.51*	.00	-.07	.09	.26*	.12*	-.08
2. Attitudes		-	-.30*	.25*	.20*	.23*	.02	-.53*	.00	-.00	.10	.14*	.01	.02
3. Subjective norms			-	-.17*	-.16*	-.17*	.03	.37*	.04	.09	-.01	-.07	-.00	.07
4. Perceived prevalence in cohort				-	.53*	.63*	.07	-.17*	.03	-.01	.08	.19*	.07	-.06
5. Perceived prevalence in academics					-	.44*	-.02	-.14*	.06	.03	.08	.04	-.00	.02
6. Perceived prevalence of PCE in University						-	.02	-.24*	.02	-.03	.07	.21*	.10*	-.04
7. PBC							-	-.01	.03	.09	.03	-.07	-.13*	.26*
8. Anticipated regret								-	.06	.04	.00	-.09	-.00	-.01
9. UWES - Vigour									-	.54*	.71*	-.33*	-.36*	.50*
10. UWES - Dedication										-	.52*	-.38*	-.65*	.60*
11. UWES - Absorption											-	-.19*	-.30*	.41*

12. Burnout - Exhaustion												-	.56*	-.35*
13. Burnout - Cynicism													-	-.47*
14. Burnout - Efficacy														-
Mean	3.14	4.02	3.60	32.85	26.31	2.37	6.09	3.07	3.19	4.54	3.23	2.62	1.55	4.49
SD	1.72	1.44	1.41	23.04	22.38	1.06	0.98	1.66	1.34	1.30	1.48	1.33	1.33	0.95

Note. *$p < .05$; PBC = perceived behavioural control;

Table 2

Means and SDs of the three groups on attitudes, subjective and descriptive norms and anticipated regret.

	Non-users		DS users		Dual users	
	M	SD	M	SD	M	SD
Intentions	2.34	1.21	3.60	1.67	4.76	1.41
Attitudes	3.52	1.38	4.38	1.34	4.84	1.16
Social Norms	3.94	1.43	3.40	1.29	3.16	1.29
PBC	6.02	1.04	6.11	0.99	6.18	0.85
Perceived prevalence in cohort	27.50	20.29	35.88	21.93	41.68	27.04
Perceived prevalence in academics	22.02	18.60	29.67	23.71	32.22	26.93
Perceived prevalence of PCE in University	2.08	1.01	2.54	1.10	2.87	1.06
Anticipated Regret	3.56	1.76	2.92	1.46	2.10	1.07

Note. DS users= dietary supplement users; PBC=Perceived behavioural control