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In-lecture learning motivation predicts students' motivation, intention, and behaviour for after-lecture learning: Examining the trans-contextual model across universities from UK, China, and Pakistan

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Abstract This paper presents a cross-cultural examination of the trans-contextual model in University education setting. The purpose of the study was to test the effect of students' perceived autonomy support and in-lecture learning motivation on motivation, intention, and behaviour with respect to after-lecture learning via the mediation of the social cognitive variables: attitude, subjective norm, and perceived behavioural control. University students from UK, China, and Pakistan completed the questionnaires of the study variables. Results revealed that in-lecture perceived autonomy support and autonomous motivation were positively associated with autonomous motivation and intention to engage in after-lecture learning activities via the mediation of the social cognitive variables in all samples. After controlling for the effect of past behaviour, relations between intention and behaviour were only observed in the Chinese sample. In conclusion, the trans-contextual model can be applied to University education, but cultural differences appear to moderate the predictive power of the model, particularly for the intention-behaviour relationship.

Keywords Self-determination theory · Theory of planned behaviour · Cross-cultural study · After-class revision · Self-efficacy · Multi-group structural equation modeling

Introduction

Adaptive teaching methods and styles of instruction, and a motivationally-appropriate classroom environment, may not only facilitate students' learning behaviour within educational contexts, but they may also foster students' independent learning behaviour in contexts outside of the classroom (Ciani et al. 2010; Kolic-Vehovec et al. 2008). One important goal for educators, therefore, is to foster students' capacity to apply the skills and concepts learned in the classroom toward self-directed learning activities outside the classroom. It is widely accepted in the educational research literature that the behaviour of significant

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social agents (e.g., teachers, lecturers) in educational settings has major influences on students' after-school learning and skill-development (Kolic-Vehovec et al. 2008; Pugh et al. 2010; Tomasetto 2004). However, little is known about the psychological processes by which the behavioural patterns of educators in educational contexts relate to students' learning motivation and behaviour outside educational environments (Hagger and Chatzisarantis 2012).

A recently-developed social psychological model, the trans-contextual model (Hagger et al. 2003, 2005), has received increasing attention. It is proposed as a feasible framework for explaining relations between the perceived behaviours of educators and students' motivation and behaviour toward educational activities across the education and extramural settings (Hagger and Chatzisarantis 2012, 2015). The purpose of the present study is to evaluate a preliminary application of the trans-contextual model in a University education context to explain the process by which perceived autonomy support (i.e., the provision of rationales, choices, care, and competence support to students) from lecturers (Black and Deci 2000; Reeve and Jang 2006) links to students' motivational, social cognitive, and behavioural factors of learning after the lecture, across three different countries (i.e., UK, China, and Pakistan). The research is expected to contribute to knowledge by investigating whether students' perception of the autonomy support offered by their lecturers is related to their motivation for educational activities in the educational context, and, most importantly, their motivation and actual behaviour for such activities in an extramural context.

The trans-contextual model

The trans-contextual model (TCM) is a multi-theory model of motivation and behaviour that integrates three prominent social psychological theories—self-determination theory (Deci and Ryan 2000, 2002), the theory of planned behaviour (Ajzen 1985, 2015), and the hierarchical model of motivation (Vallerand 2000). The purpose of the model is to outline the processes by which motivation for educational activities (e.g., participating in class, listening to and following teachers' instruction) is transferred to motivation and behaviour of educational activities in extra-mural or leisure-time contexts (e.g., homework, practice, revision). The concept of perceived autonomy support (i.e., beliefs that significant others provide choice, options, and support for one's initiatives and values; McLachlan and Hagger 2010b), derived from self-determination theory (SDT), is central to the TCM. It is postulated in the model that perceived autonomy support from teachers in educational contexts is not only related to students' self-determined motivation toward educational activities in the classroom, but also to students' self-determined motivation toward a learning-related activities outside of the educational context (Hagger and Chatzisarantis 2012).

The organismic and dialectical perspective endorsed by SDT postulates that people have an innate tendency to overcome challenges, derive interest and enjoyment, and explore their potential in the activities they pursue (Deci and Ryan 2000, 2002). Central to the theory is the construct of self-determined or *autonomous* motivation. This form of motivation is considered adaptive because it accounts for the quality, rather than merely the quantity, of motivation by identifying the reasons why individuals engage in particular behaviours (Deci and Ryan 2000, 2002). Specifically, individuals endorse autonomous motivation when they perform activities for personally-valued goals and to attain self-endorsed outcomes. In contrast, *controlled* motivation is defined as engaging in activities for external contingencies (e.g., gaining reward, avoiding punishment) or ego involvement (e.g., gaining recognition and approvals from others, or avoiding internal feelings of guilty and shame). Autonomous motivation, as posited by SDT, is associated with more adaptive psychological and behavioural outcomes such as well-being and persistence because it is consonant with individuals' innate psychological needs for autonomy, competence, and relatedness. These needs are considered basic and universal and the satisfaction of the needs, particularly the need for autonomy, is considered fundamental to optimal functioning and psychological well-being (Deci and Ryan 2000, 2002; Sheldon et al. 2001). The needs provide the basis for motivational styles in given contexts and it is the satisfaction of psychological needs that serves as the 'nutriment' of future behavioural engagement (Deci and Ryan 2000). In contrast, controlled motivation is associated with maladaptive psychological and behavioural outcomes such as negative affect and behavioural desistance because it is incongruent with psychological needs.

The fundamental proposition of the TCM, that is, the transfer of motivation across contexts, is derived from tenets of Vallerand's (2000) hierarchical model of motivation. Vallerand's hierarchical model extends SDT by specifying that motivation operates at different levels (global, contextual, and situational) and varies over time. Based on Vallerand's corollary in the hierarchical model that there will be interplay between motivational styles from SDT at the contextual level, a key premise in the TCM is that self-determined motivation is transferable from a primary context (e.g., education) to self-determined motivation in a secondary context (e.g., extra-mural) that is closely related to the primary one. This trans-contextual process of motivation might explain how autonomy support from teachers is indirectly related to students' learning motivation outside school via learning motivation in the

classroom (Hagger and Chatzisarantis 2012). Hagger and Chatzisarantis (2015) propose that the process underpinning the trans-contextual motivational effect relates to the motivational schema or script developed by experiences of motivation in the primary context. This motivational script is stored in memory and provides an action pattern or template for action when cues that signal opportunities for like behaviours to be enacted become salient.

In Vallerand's model, interplay between motivational constructs at the contextual level occurs at the motivational, emotional, and cognitive level (Vallerand 2000). And motivational transfer is the result of a 'pattern matching' process in which the stored motivational pattern in one context has good fit with the features of the behaviour in the other, particularly the cues that lead to the initiation of that behaviour. The presentation of the cues leads to an automatic activation of the schema for the motivated behaviour in the previous context and the motivational pattern or template is enacted leading to motivation to engage in the behaviour in the secondary, extra-mural context. This likely leads to individuals forming intentions to engage in the behaviour in the secondary context and aligning their beliefs with respect to the behaviour so that they are consistent with the motivational orientation represented in the schema. In the TCM, this process is captured by the theory of planned behaviour (Ajzen 1985, 2015).

Specifically, the TCM proposes a motivational sequence in which self-determined motivation is related to behaviour indirectly, mediated by the social cognitive variables and intention from the theory of planned behaviour (Ajzen 1985, 2015). Self-determined motivation is proposed to positively predict the social cognitive variables (Hagger and Chatzisarantis 2012, 2015), including attitude (i.e., general beliefs that the behaviour will lead to desirable outcomes), subjective norm (i.e., perceptions of significant others' approval of performing the behaviour), and perceived behavioural control (PBC; i.e., the perception of ability, capacity, and resources to keep the behaviour under control). While SDT and theory of planned behaviour occupy different epistemological perspectives, the integration of the two perspectives is based on the original premise proposed by Deci and Ryan (1985) that individuals will tend to align their social cognitive beliefs about future behavioural engagement with their motivation. If individuals have experienced a behaviour as one that is driven by high autonomous motivation and low controlled motivation, it will be identified as one that has the potential to satisfy psychological needs. The individual will then be compelled to seek out that behaviour in order to satisfy the need in future. In order to do so, he or she would need to strategically align their beliefs and intentions with respect to engaging in the need-satisfying behaviour in future. As a consequence, the beliefs will correspond with the individual's motivation. Incorporating the constructs from the theory of planned behaviour into the TCM, therefore, provides a formal means to test the process by which motivation in both educational and extra-mural contexts are associated with future behaviour in the extra-mural context (Hagger and Chatzisarantis 2015; Hagger et al. 2015).

Research has provided evidence that individual motives align closely with their behavioural beliefs (Hagger et al. 2006a, b; McLachlan and Hagger 2010a, 2011). Consistent with hypotheses from the theory of planned behaviour, the three social cognitive variables are hypothesised to form positive associations with behaviour mediated by intention (Ajzen 1985, 2015). Research testing the theoretical integration between self-determination theory and the theory of planned behaviour has supported the proposed motivational sequence, showing that motivation is a distal predictor of behaviour mediated by constructs from the theory of planned behaviour (Chan et al. 2014b, c Chan and Hagger 2012c; Hagger and Chatzisarantis 2009b).

Support for the TCM

A growing number of studies have tested the hypotheses of the TCM, primarily in physical education (PE) settings. After the initial validation of the TCM conducted among UK PE students (Hagger et al. 2003), further replications have been conducted cross-culturally in samples from the Greece, Poland, Singapore, Hungary, Finland, and Estonia, supporting the application of TCM in PE settings and its cross-cultural generalisability (Hagger et al. 2005, 2009). There have also been applications of the model to explain the trans-contextual process of motivation in other health-related domains including rehabilitation (Chan et al. 2011), injury prevention (Chan and Hagger, 2012a, d), and anti-doping (Chan et al. 2015). Recent meta-analyses and narrative reviews have also demonstrated support for the fundamental premises of the TCM in multiple samples and from multiple research groups (Hagger and Chatzisarantis 2012, 2015).

To date, only one study has applied the TCM to explain the process by which self-determined motivation toward learning in school is related to motivation toward after-school learning behaviour. Hagger et al. (2015) examined the TCM among high school students' learning behaviour from Pakistan. It was found that autonomous motivation for participating in in-school mathematics activities was predicted positively by perceived autonomy support from mathematics teachers. Further, autonomous motivation toward in-school mathematics activities was a positive predictor of autonomous motivation toward after-school math homework. Intention to engage in mathematics

homework was positively predicted by autonomous motivation for doing after-school mathematics homework mediated by the social cognitive factors, and was a positive predictor of prospective indices of behavioural adherence including mathematics homework completion and homework grades (Hagger et al. 2015). This initial evidence showed that TCM can also explain the motivational processes that underpin students' academic behaviour and academic performance.

Nevertheless, this initial test of the TCM in an academic context was conducted in Pakistan, a nation where very little research on the motivation of learning behaviour has been conducted, so the results may potentially differ from other countries due to variations in cultural orientation of the participating students. A frequently-cited and well-researched cross-cultural dimension that has been used to characterise cultural orientations in national groups is the distinction between collectivism and individualism. Pakistan is identified as a national group that tends to endorse collectivist values according to a recent classification (Hofsted et al. 2010). Research indicates that motivational patterns differ across cultures in that national groups or individuals that endorse individualist values emphasize individual freedoms and the pursuit of personal goals, while national groups or individuals that endorse collectivist values tend to focus on contribution to the larger group and the pursuit of group goals (Hagger et al. 2014; Markus and Kitayama 1991, 2003; Tamis-LeMonda et al. 2008). There is, therefore, potential scope to study, apply and test the TCM toward educational activities in national groups that typically endorse individualist (e.g., UK) and collectivist (e.g., China) cultural norms beyond the culture in which the supporting evidence was originally obtained (Pakistan) in order to examine the cross-cultural invariance of the TCM in predicting students' academic behaviours.

Importantly, theorists have proposed that the TCM and its component models and theories are expected to represent generalisable patterns of action that will likely be consistent regardless of cultural group (Chirkov 2009; Hagger and Chatzisarantis 2015; Hagger et al. 2007). This is because theories of motivation like self-determination theory and theories of social cognition like the theory of planned behaviour assume that the motivational and information processes that underpin their predictions are consistent across individuals and, therefore, independent of cultural norms. There is some support for these assumptions in previous cross-cultural research on self-determination theory (Chirkov 2009; Hagger and Chatzisarantis 2011), the theory of planned behaviour (Bagozzi et al. 2001; Hagger et al. 2007), and the TCM (Hagger et al. 2005, 2009) with indications that the general patterns of prediction tend to be largely replicated. This support notwithstanding, the relative strength of the predictions may vary across culture. This has paved the way for calls to examine and confirm the cross-cultural generalisability of the proposed patterns of prediction proposed in models of motivation.

The present study

The purpose of the present study was to test the propositions of the TCM in University students from three countries: the UK, China, and Pakistan. These countries were selected because of their specific cultural characteristics. UK is a good example of a national group that tends to endorse individualist cultural orientations, while China is typically regarded as country that adopts a predominantly collectivist orientation (Hofsted et al. 2010; Triandis 1989, 1995). People from Pakistan tend to adopt a collectivist cultural orientation according to Hofstede et al. (2010), and this is the cultural context in which the TCM has been applied to an academic context. However, based on the premise of the universality and generalisability of the proposed effects in the TCM (Hagger and Chatzisarantis 2012, 2015; Hagger et al. 2005), we proposed that the propositions of the TCM would be applicable in all three national samples to explain the trans-contextual transfer of motivation. We therefore expected that the proposed pattern of effects outlined in the motivational sequence of the TCM would be invariant across the groups. Specifically, we predicted that:

H1 Students' perceived autonomy support from University lecturers would be positively associated with students' in-lecture autonomous learning motivation, and its association with students' in-lecture controlled learning motivation would either be negative or non-significant.

H2 In-lecture autonomous and controlled learning motivation would positively predict the corresponding types of motivation for after-lecture learning activities consistent with the trans-contextual proposition of the TCM.

H3 The social cognitive variables from the theory of planned behaviour (i.e., attitude, subjective norm, and PBC) would be positively related to after-lecture autonomous motivation for learning activities, and their relationship with after-lecture controlled learning motivation would be non-significant.

H4 The social cognitive variables would be positively related to intentions to engage in after-lecture learning activities, and would mediate the prediction of autonomous motivation and controlled motivation on intention of after-lecture learning activity.

H5 Intention would be a positive predictor of after-lecture learning activities.

H6 The hypothesised parameter estimates (as indicated by H1–H5) would be invariant across UK, China, and Pakistan.

Methods

Participants

Participants were undergraduate students recruited from three Universities located in the UK, China, and Pakistan. Data from the UK sample (N = 245; M age = 19.49, *SD* = 1.46; 26.53 % male) comprised undergraduate psychology students from the University of Nottingham. According to the statistics of the institution, the ethnicity of the majority (87 % in 2009) of the students is white Caucasian, which is consistent with the overall ethnicity distribution in the UK. The sample from China (N = 107; M age = 20.14, *SD* = 2.98; 79.44 % male) comprised undergraduate students enrolled in a sport psychology course in the University of Chengdu Sport University. Participants were all of Chinese ethnicity. Data from the Pakistan sample (N = 90; M age = 19.45, *SD* = 1.26; 23.33 % male) was obtained from University of Bahauddin Zakariya University and comprised students enrolled in a health psychology course. Participants were all of Pakistan ethnicity. In all the courses, students were asked to complete coursework, projects, and examinations. Each week, participants were required to attend an average of two course lectures (class size approximately one hundred students), each lasting approximately 90 min, organised and led their lecturers. They also spent time revising their lecture notes or reading course materials (UK = 1.54 h, *SD* = 2.09; China = 3.57 h, *SD* = 2.99; Pakistan = 1.60 h, *SD* = 2.09) and doing coursework (UK = 2.46 h, *SD* = 3.43; China = 2.02 h, *SD* = 2.28; Pakistan = 2.59 h, *SD* = 3.51).

Procedure

The present study adopted a three-wave prospective survey design identical in design to previous studies testing the TCM (Hagger et al. 2003, 2005). In the first wave of data collection, participants were asked to complete items relating to their demographic details, scales of perceived autonomy support, and in-lecture learning motivation. One week later, participants completed the second survey that comprised measures of autonomous and controlled forms of motivation, the social cognitive variables and intention from the theory of planned behaviour, and behavioural adherence for after-lecture learning activities. The 1-week latency period between the first two waves of data collection was adopted to reduce the common method variance associated with the use of similar methods to measure constructs based on SDT (Hagger et al. 2003, 2005). Five weeks after the first wave, participants completed a third wave of data collection comprising measures of behavioural adherence toward after-lecture learning activities. The latency period between wave 2 and wave 3 allowed a 5-week prospective prediction of behavioural adherence by the psychological and behavioural constructs. Participants were reminded that they were to refer to the same course or subject (hence, the same lecturer) when responding to the survey items.

As participants attended two to three lectures of their corresponding course each week, data collection occurred at the end of the lectures without the presence of the lecturer, and follow-up surveys were facilitated by delivering the questionnaires in the subsequent teaching weeks after baseline. Participants absent at data collection were given another chance to complete the questionnaire in a subsequent lecture in the same week, or they could complete an online version of the questionnaire. Therefore, no participant from China and Pakistan dropped out from the study at follow-up. However, 159 participants from the UK only completed measures at data collection waves 1 and 2 due to absence or dropout from the study, and no subsequent opportunity to complete the questionnaire in wave 3 was available.

Ethical approval for the study was granted from the Human Research Ethics Committee of the first author' institution. Participants signed the consent form to confirm that they agreed to participate. The consent forms, questionnaire items and scale instruction were originally developed and tested in English, so they were translated into the first language of the Chinese and Pakistan participants using a standardised back-translation procedure (Hambleton 2005).

Measures

Perceived autonomy support

The six-item short version of the Learning Climate Questionnaire (Black and Deci 2000) was used to measure students' perception of autonomy support by their lecturer in the first wave of data collection. The scale items were adapted to refer to "my lecturer" and participants were required to rate how true each of six the statements was as a description of their lecturer's autonomy supportive behaviours on a seven-point Likert scales.

Student motivation

Students' learning motivation was evaluated using an adapted version of Academic Self-Regulation

Questionnaire (ASRQ; Black and Deci 2000) in the first wave of data collection. For students' in-lecture learning motivation, we adapted sixteen items of the scale by modifying the common item stem so that it made reference to behaviours in the specific context: "I try to take notes and to listen attentively in lectures because…". Similarly, sixteen items from the ASRQ were adapted to measure student motivation for after-lecture learning in the second wave of data collection. We modified the common item stem to be context-appropriate: "I revise and study the subject after lectures because…" Items measuring autonomous (i.e., intrinsic motivation and identified regulation) and controlled (i.e., extrinsic and introjected regulation) forms of motivation were taken directly from the original version of ASRQ. Participants rated the extent to which they agreed with the items on seven-point Likert-scales.

Theory of planned behaviour

Eleven items assessed the social cognitive variables (attitude, subjective norm, and PBC) and intention from the theory of planned behaviour for after-lecture in the second wave of data collection. The items were constructed according to Ajzen's (2002a) guidelines. Participants rated the degree to which they endorsed with the item on seven-point Likert scale.

Behavioural adherence

We adapted seven items from a previous study measuring students' effort for doing homework or revising for mathematics lessons after-school (Trautwein 2007) to measure after-lecture learning. Participants reported how much effort they invested in after-lecture learning (i.e., doing coursework and studying) on a seven-point Likert-type scales. The measure was administered at wave 3 and constituted our target outcome variable. However, we also administered the measure at wave 2 to measure past-behaviour. The inclusion of a measure of past-behaviour is recommended by Hagger et al. (2003, 2009, 2015a, b) to evaluate whether the predicted paths of the TCM would hold after controlling the effect of past behaviour. This is an important endeavor of any social psychological and motivational model because it is important that the hypothesised effects of motivational variables on behaviour remain after accounting for previous experience. If the model variables fail to explain any unique variance in behaviour, then it suggests that habit or behavioural frequency is the sole determinant of behaviour rendering the model redundant as it provides no explanatory value above past behavioural frequency (Ajzen 2002b; Ouellette and Wood 1998). In such cases behaviour may either be a function of habitual or automatic processes or some other unmeasured constructs unaccounted for by the redundant model (Gardner 2015; Hagger et al. 2015; Rebar et al. 2015).

Analysis

In order to test the hypotheses of the TCM and its cross-cultural invariance, variance-based structural equation modeling (VB-SEM) was employed using the WarpPLS 4.0 statistical software (Kock 2013). Unlike covariance-based structural equation modeling (CB-SEM) that has specific requirements for sample size and normality of the data, VB-SEM estimates the goodness of fit and parameter estimates of the model using a distribution-free algorithm, namely partial least-squares. Hair et al. (2012) suggested that VB-SEM could be employed in conjunction with CB-SEM, and the sample size and number of indicator should be increased to infinite for an error-free estimation of latent factors. However, statistical power analysis (Chan 2009; MacCallum et al. 1996) showed that the sample size in the datasets was not sufficiently large for supporting CB-SEMs. The sample size of our smallest sample indeed exceeded the minimum sample size requirements for running VB-SEMs for our hypothesised model (Barclay et al. 1995), so VB-SEM, instead of CB-SEM, was conducted for our study. The partial least-squares estimation method is able to construct error-free latent factors without placing any assumption on the sampling distribution, model estimation was assumed to be unaffected by small sample size or complex model structure (Reinartz et al. 2009), making it ideal for the present investigation.

In VB-SEM, the convergent and discriminant validity of the model are typically considered acceptable when factor loadings (>.70, and >all cross-loadings), averaged variance extracted (AVE; >.50), composite score reliability (>.70), and Cronbach's alpha (>.70), and square-root of AVE (>mean factor-to-factor correlation) exceed the proposed criteria (Barclay et al. 1995; Chin 1998; Henseler et al. 2009). The global fit of the model is acceptable when the Goodness-of-fit index (GoF; >.25), averaged variance inflation factor (AVIF; <5), averaged full collinearity VIF (AFVIF; <5), averaged R-squared (ARS; <.05), and averaged path coefficient (APC; <.05) meet the criteria for acceptable goodness-of-fit (Tenenhaus et al. 2005; Wetzels et al. 2009).

To ensure the stability of model in data from the UK, China, and Pakistan samples, we used a bootstrapping resampling technique with 999 replications (the maximum number of replications permitted in WarpPLS) to produce the averaged path estimates in the structural model. In addition, we conducted mediation analyses for all possible mediation pathways within the TCM. Mediation was confirmed when the indirect and total effects were statistically

significant (Hayes 2009; Zhao et al. 2010). In the present study, we used the UK sample as our reference group, and we tested the initial measurement and structural models of the TCM in data from the UK sample (N = 245) who completed the first two waves of measurement. This baseline model (Model 1) included all the factors in the TCM apart from the behavioural adherence measure in the third wave of data collection. The purpose of this initial model was to utilise the full UK dataset to examine the factorial validity and internal consistency of the study measures before we conducted further analysis. In particular, the model comprised all the factors and structural pathways among the perceived autonomy support, in-lecture learning motivation, after-lecture learning motivation, social cognitive factors, and intention factors. Past behaviour (i.e., behavioural adherence measured in the second wave of data collection) was included as a control variable[1] and set to predict all other factors in the model (Hagger et al. 2003, 2005).

When the psychometric properties of the baseline model were confirmed, we included our measure of after-lecture learning behaviour in subsequent tests of the full TCM in the prospective datasets from the UK (Model 2; N = 87; the participants who completed the survey across all three waves), China (Model 3; N = 107), and Pakistan (Model 4; N = 90). Current behaviour was estimated as a latent factor predicted by intention and past behaviour. As such, the intention-behaviour pathway could reveal the extent to which intention was predictive of behaviour change over the 5-week period. We used the multi-group VB-SEM protocol proposed by Sarstedt et al. (2011) to examine the invariance of the model pathways between Model 2, Model 3, and Model 4. Particularly, we used the omnibus test of group differences to review the overall difference of each path estimate between Models 2–4. When the variance ratio (i.e., the ratio between between-subject and within-subject sum of squares) was significant (i.e., $p < .05$), we concluded that the path estimate was significantly different across the UK, China, and Pakistan groups. We also employed Henseler's (2012) non-parametric test to make comparisons of the parameter estimates between each pair of national groups (Henseler 2012; Sarstedt et al. 2011). Sarstedt et al. (2011) recommend that a reasonable number of bootstrapped estimates (e.g., 5000) be generated to ensure robust multi-group VB-SEM comparisons. As WarpPLS 4.0 could only handle up to 999 bootstrapped replications (Kock 2013), we used SmartPLS-M3 (Ringle et al. 2005) to export 5000 bootstrapped values for each parameter estimate in the model for the omnibus test and Henseler's (2012) non-parametric test.

[1] We conducted additional analyses in which we included gender and self-reported time spent on after-lecture learning (e.g., coursework, revision) as additional observed factors that predicted all other variables in the model to control its effects. The pattern of the findings was identical to the model that excluded the control variables and the coefficient effect sizes remained almost the same. Therefore, in order to maintain a parsimonious model, we decided not to include the control variables in the VB-SEM analysis.

Results

Measurement level analysis

Focusing first on the measurement-level statistics for the VB-SEM models, the convergent and discriminant validity of the latent variables was acceptable across all the models and countries (see Table 1 for the fit indices and descriptive statistics for each model). The Cronbach's alpha (range .70 to .94), composite score reliability (range .79 to .96), AVE (range .50 to .89), and factor loadings (range .72 to .94) met published criteria for supporting the convergent validity of the latent factors in the model. The factor loadings were higher than the cross-loadings by an average of .56 (range .39 to .77), and the square-root of the AVE was higher than the mean factor-to-factor correlation of any latent factor by an average of .42 (range .21 to .66). These findings provided support for the discriminant validity of the latent factors. Finally, the goodness-of-fit indicators also showed that the model exhibited good fit with the data (see Table 2). Table 3 displays the latent-factor correlations among the variables in each dataset.

Structural level analysis

The path estimates of all the models were highly consistent with the hypotheses of the TCM (see Table 4):

H1 Perceived autonomy support was a significant and positive predictor of in-lecture autonomous motivation and control motivation.

H2 In-lecture autonomous motivation significantly and positively predicted after-lecture autonomous motivation, but not after-lecture controlled motivation. In-lecture controlled motivation positively and significantly predicted after-lecture controlled motivation but not after-lecture autonomous motivation.

H3 After-lecture autonomous motivation was significantly and positively associated with attitudes and PBC, but not subjective norms. After-lecture controlled motivation was significantly and positively related to subjective norm, but not attitudes and PBC.

H4 Attitudes, subjective norms, and PBC were significantly and positively associated with intention in all countries, apart from a non-significant association between

Table 1 Convergent and discriminant validity indices of all samples

		Support	In-Auto	In-Cont	After-Auto	After-Cont	Attitude	Norm	PBC	Intention	Past-Behav	Curr-Behav
UK Cross-Sectional	Mean	3.84	5.37	4.12	4.57	3.76	5.39	5.39	5.45	5.60	4.81	-
	SD	1.17	.89	.91	1.00	1.03	.87	1.09	1.08	1.14	.95	-
	α	.88	.85	.79	.86	.81	.81	.74	.87	.91	.71	-
	CR	.91	.89	.84	.89	.85	.86	.85	.90	.95	.80	-
	AVE	.63	.57	.55	.51	.53	.52	.66	.65	.85	.56	-
	F-Loading	.88	.72	.73	.74	.74	.74	.75	.74	.70	.72	-
	C-Loading	.11	.23	.18	.16	.16	.11	.18	.14	.23	.19	-
	R^2	-	.20	.11	.50	.45	.31	.11	.14	.45	-	-
UK Prospective	Mean	3.91	5.57	4.10	4.78	3.69	5.57	5.51	5.61	5.62	5.06	4.93
	SD	1.15	.75	.87	1.00	.90	.77	1.02	1.00	1.24	.78	.75
	α	.89	.82	.77	.91	.76	.85	.85	.87	.94	.71	.74
	CR	.92	.87	.83	.92	.82	.89	.91	.91	.96	.80	.82
	AVE	.65	.53	.54	.61	.57	.57	.77	.67	.89	.56	.50
	F-Loading	.80	.73	.77	.78	.72	.75	.88	.82	.94	.72	.71
	C-Loading	.13	.25	.15	.28	.14	.27	.14	.18	.21	.26	.23
	R^2	-	.27	.19	.59	.45	.45	.11	.26	.62	-	.34
China Prospective	Mean	4.68	5.24	4.51	4.77	4.30	5.50	5.01	5.32	4.94	4.91	4.83
	SD	1.35	1.28	1.12	1.23	1.19	1.12	1.27	1.12	1.28	1.02	1.04
	α	.83	.83	.78	.89	.78	.85	.74	.80	.87	.79	.76
	CR	.88	.88	.83	.92	.83	.89	.85	.86	.92	.85	.83
	AVE	.55	.54	.53	.58	.50	.59	.66	.56	.79	.58	.51
	F-Loading	.74	.74	.77	.76	.72	.76	.81	.75	.89	.74	.74
	C-Loading	.29	.35	.19	.36	.20	.27	.25	.22	.33	.21	.28
	R^2	-	.62	.40	.55	.51	.33	.22	.19	.51	-	.36
Pakistan Prospective	Mean	3.92	5.61	4.09	4.80	3.65	5.57	5.50	5.60	5.65	5.07	4.94
	SD	1.14	.76	.86	.98	.94	.75	1.04	1.02	1.24	.77	.74
	α	.88	.83	.77	.90	.78	.83	.84	.87	.94	.70	.73
	CR	.91	.87	.83	.92	.84	.88	.90	.91	.96	.79	.81
	AVE	.63	.54	.54	.59	.59	.55	.75	.66	.89	.56	.59
	F-Loading	.79	.73	.76	.77	.72	.73	.87	.81	.95	.72	.79
	C-Loading	.13	.23	.14	.27	.14	.26	.14	.17	.29	.25	.21
	R^2	-	.26	.20	.57	.51	.46	.13	.27	.59	-	.35

Support = perceived autonomy support from the lecturer; In-Auto = in-lecture autonomous motivation; In-Cont = in-lecture controlled motivation; After-Auto = after-lecture autonomous motivation; After-Cont = after-lecture controlled motivation; Norm = subjective norm; PBC = perceived behavioural control; Intention = intention; Past-Behav = past-behaviour; Curr-Behav = current-behaviour; CR = composite reliability; AVE = average variance extracted; F-loading = mean factor loadings; C-Loading = mean cross-loadings. R^2 is the variance explained in the mediation model

** $p < .01$ at 2-tailed; * $p < .05$ at 2-tailed

PBC and intention in China. Mediation analysis showed that the social cognitive variables that correlated intention significantly mediated the relationship between autonomous motivation and intention of after-lecture learning activity. The relationship between controlled motivation and intention of after-lecture learning activity was mediated by subjective norm only in the sample of China, and the proposed mediation pathway for controlled motivation was not supported in other samples.

H5 Finally, intention significantly and positively predicted after-lecture learning behaviour, but when the effect of past-behaviour was controlled, the prediction was only significant in the Chinese sample, but not in UK and Pakistan samples.

Cross-cultural comparisons

Henseler's (2012) invariance test revealed few significant differences in the size of paths across the three countries. Specifically, the perceived autonomy support → in-lecture autonomous motivation, and the subjective norm → intention paths were stronger in China than in UK. The in-lecture controlled motivation → after-lecture controlled motivation was stronger in Pakistan than in China. Figure 1 displays a summary of the path estimates of all models and the results of the multi-group analysis. The results of the mediation analysis are mixed between different models. In general, only three mediation pathways (i.e., perceived autonomy support → after-lecture autonomous motivation,

Table 2 Good of fit indices

Model	GoF	AVIF	AFVIF	ARS	APC
1. UK cross-sectional	.38	1.23	1.70	.25, $p < .01$	.23, $p < .01$
2. UK prospective	.43	1.31	2.04	.33, $p < .01$	.26, $p < .01$
3. China prospective	.46	1.74	2.41	.39, $p < .01$	.28, $p < .01$
4. Pakistan prospective	.43	1.30	2.00	.34, $p < .01$	.26, $p < .01$

GoF goodness-of-fit index, *AVIF* averaged variance inflation factor, *AFVIF* averaged full collinearity averaged variance inflation factor, *APC* averaged path coefficient

Table 3 Correlations among study variables for the four samples

Correlations		1	2	3	4	5	6	7	8	9	10	11
		UK Cross-Sectional Data (N = 245)										
1. Support	UK Prospective Data (N = 87)	1.00	.20**	.26**	.24**	.08	.11	.06**	.18**	.08	.08	-
2. In-Auto		.36**	1.00	.31**	.51**	.14*	.41**	.24**	.33**	.34**	.34**	-
3. In-Cont		.38**	.26*	1.00	.19**	.61**	.10	.26**	-.04	.09	.12	-
4. After-Auto		.25*	.59**	.11	1.00	.28**	.56**	.20**	.32**	.40**	.58**	-
5. After-Cont		.17	.13	.66**	.19	1.00	.14*	.21**	-.03	.08**	.22**	-
6. Attitude		.17	.38**	.11	.64**	.20	1.00	.35**	.39**	.56**	.39**	-
7. Norm		-.03	.12	.26*	.17	.22**	.25*	1.00	.38**	.43**	.24**	-
8. PBC		.23*	.26*	-.05	.44**	-.10	.40**	.29**	1.00	.44**	.25**	-
9. Intention		.06	.33**	.09	.49**	.19	.59**	.41**	.49**	1.00	.31**	-
10. Past-Behav		.04	.39**	.05	.60**	.18	.53**	.22*	.32**	.61**	1.00	-
11. Curr-Behav		.03	.39**	.07	.48**	.16	.48**	.13	.23*	.41**	.56**	1.00
		Pakistan Data (N = 90)										
1. Support	China Data (N = 107)	1.00	.36**	.39**	.24*	.18	.17	-.03	.24*	.03	.03	.01
2. In-Auto		.71**	1.00	.23*	.57**	.11	.38*	.10	.24*	.33**	.38**	.36**
3. In-Cont		.60**	.69**	1.00	.08	.68**	.11	.29**	.01	.05	.03	.04
4. After-Auto		.52**	.59**	.40**	1.00	.17	.63**	.15	.40**	.49**	.60**	.48**
5. After-Cont		.37**	.41**	.47**	.64**	1.00	.22*	.29**	.03	.16	.17	.14
6. Attitude		.27**	.39**	.20*	.51**	.20*	1.00	.25*	.40**	.58**	.52**	.47**
7. Norm		.23*	.32**	.28**	.36**	.45**	.35**	1.00	.35**	.37**	.18	.13
8. PBC		.20*	.29**	.16	.34**	.21*	.48**	.52**	1.00	.44**	.28**	.21**
9. Intention		.25**	.41**	.28**	.54**	.31**	.57**	.59**	.52**	1.00	.61**	.42**
10. Past-Behav		.33**	.48**	.34**	.63**	.54**	.45**	.31**	.27**	.32**	1.00	.56**
11. Curr-Behav		.34**	.36**	.34**	.54**	.43**	.36**	.31**	.25**	.40**	.54**	1.00

Correlations among study variables for UK cross-sectional data appear in the upper matrix above the principal diagonal; Correlations for the UK prospective data appear in the upper matrix below the principal diagonal; Correlations for the Pakistan data appear in the lower matrix above the principal diagonal; Correlations for the China data appear in the lower matrix below the principal diagonal. Support = perceived autonomy support from the lecturer; In-Auto = in-lecture autonomous motivation; In-Cont = in-lecture controlled motivation; After-Auto = after-lecture autonomous motivation; After-Cont = after-lecture controlled motivation; Norm = subjective norm; PBC = perceived behavioural control; Intention = intention; Past-Behav = past-behaviour; Curr-Behav = current-behaviour

** $p < .01$ at 2-tailed; * $p < .05$ at 2-tailed

perceived autonomy support → after-lecture controlled motivation, and after-lecture autonomous motivation → intention) were shown to be statistically significant and consistent across samples, other significant mediation pathways were only observed for some models (see Table 5 for details).

Discussion

We applied the TCM to investigate the motivational and social cognitive predictors of after-lecture learning behaviour in University students in three different countries. Our results supported the main premises of the model in a

Table 4 Parameter estimates

Paths	UK-Cross (Model 1) β (95 % CI)		UK-Pros (Model 2) β (95 % CI)		China-Pros (Model 3) β (95 % CI)		Pakistan-Pros (Model 4) β (95 % CI)		Group difference[a]
Support → In-Auto	.18**	(.10, .33)	.32**	(.17, .53)	.63**	(.53, .77)	.31**	(.16, .54)	China-Pros > UK-Pros**
Support → In-Cont	.25**	(.17, .42)	.43**	(.02, .77)	.58**	(.45, .77)	.45**	(.09, .74)	
In-Auto → After-Auto	.35**	(.25, .48)	.48**	(.23, .58)	.23*	(.00, .49)	.45**	(.22, .55)	
In-Auto → After-Cont	.10	(−.27, .09)	−.03	(−.33, .17)	.12	(−.35, .15)	.00	(−.32, .12)	
In-Cont → After-Auto	.06	(−.08, .14)	−.05	(−.24, .19)	.13	(−.09, .29)	−.03	(−.23, .17)	
In-Cont → After-Cont	.60**	(.51, .73)	.66**	(.33, .98)	.40**	(.12, .56)	.69**	(.39, .99)	Pakistan-Pros > China-Pros*
After-Auto → Attitude	.47**	(.39, .67)	.43**	(.24, .70)	.44**	(.21, .84)	.43**	(.25, .69)	
After-Auto → Norm	.06	(−.15, .25)	.07	(−.35, .31)	.05	(−.30, .52)	.08	(−.35, .31)	
After-Auto → PBC	.28**	(.11, .47)	.46**	(.12, .68)	.27*	(.02, .64)	.46**	(.06, .64)	
After-Cont → Attitude	.04	(−.19, .12)	.04	(−.15, .30)	.01	(−.46, −.03)	.03	(−.12, .28)	
After-Cont → Norm	.18*	(.01. .36)	.18*	(.13, .56)	.37**	(.05, .77)	.23*	(.09, .61)	
After-Cont → PBC	−.09	(−.34, .06)	−.20	(−.56, .35)	.04	(−.24, .30)	−.31	(−.46, .48)	
Attitude → Intention	.37**	(.23, .51)	.24*	(.03, .48)	.36**	(.17, .56)	.27**	(.06, .49)	
Norm → Intention	.17*	(.05, .33)	.19*	(.04, .38)	.41**	(.21, .60)	.20*	(.04, .39)	China-Pros > UK-Pros*
PBC → Intention	.21*	(.09, .37)	.27**	(.01, .42)	.13	(−.05, .36)	.22*	(.04, .37)	
Intention → Curr-Behav	N/A	N/A	.09	(−.18, .30)	.22*	(.03, .42)	.12	(−.15, .32)	

UK-Cross = the full cross-sectional dataset from the UK (N = 245); UK-Pros = the prospective dataset from the UK (N = 87); China-Pros = the prospective dataset from China (N = 107); Pakistan-Pros = the prospective dataset from Pakistan (N = 87). Support = perceived autonomy support from the lecturer; In-Auto = in-lecture autonomous motivation; In-Cont = in-lecture controlled motivation; After-Auto = after-lecture autonomous motivation; After-Cont = after-lecture controlled motivation; Norm = subjective norm; PBC = perceived behavioural control; Intention = intention; Curr-Behav = current-behaviour. Past-behaviour is a control variable of all paths in this table, and its associated path estimates are not displayed for clarity reason

** $p < .01$ at 2-tailed; * $p < .05$ at 2-tailed

[a] Significance of the difference between the path estimate of Model 2 (UK-prospective), Model 3 (China-prospective), and Model 4 (Pakistan-prospective) are shown. The pairs of countries with significant group differences (i.e., significant in both Omnibus test (Sarstedt et al. 2011) and Henseler's non-parametric test) are displayed

higher-education context for the first time with consistency in the pattern of effects across the three samples. When students perceived that their lecturers supported their autonomy they were more likely to endorse autonomous motivation for learning in the lecture and, critically, more likely to endorse autonomous motivation toward after-lecture learning activities. On the other hand, when students held high controlled motivation toward learning in the lecture, they were more likely to endorse controlled motivation toward learning after the lecture. This pattern of results is consistent with the tenets of the TCM (Hagger and Chatzisarantis 2012, 2015; Hagger et al. 2003, 2009) and the findings of a previous application of the TCM to investigate secondary school students' mathematics learning outside of school (Hagger et al. 2015). It illustrates that the motivational sequence proposed in the model provides a basis to explain the process by which motivation transfers from the lecture room to home-based learning contexts. Findings imply that the potential effects of lecturers' autonomy support are exerted not only on students' in-lecture motivation for learning, but also on students' motivation for educational activities after the lecture.

This promising finding also provides an indication as to how teaching style or methods adopted by educators in an educational context affect students' motives to learn outside of the educational context (Ciani et al. 2010; Kolic-Vehovec et al. 2008). If the primary goal of tertiary education is to engender motivation to engage in independent self-study and promote students' capacity to cope with the academic demands outside the formal education context (Kolic-Vehovec et al. 2008; Pugh et al. 2010; Tomasetto 2004), the trans-contextual process of motivation would provide a feasible explanation of how lecturers or teachers could foster students' initiative and adaptive behavioural patterns for self-directed learning after-school (Hagger and Chatzisarantis 2012). Consistent with the TCM (Hagger and Chatzisarantis 2012), the findings of the present study provide some indication that lecturers or teachers may be

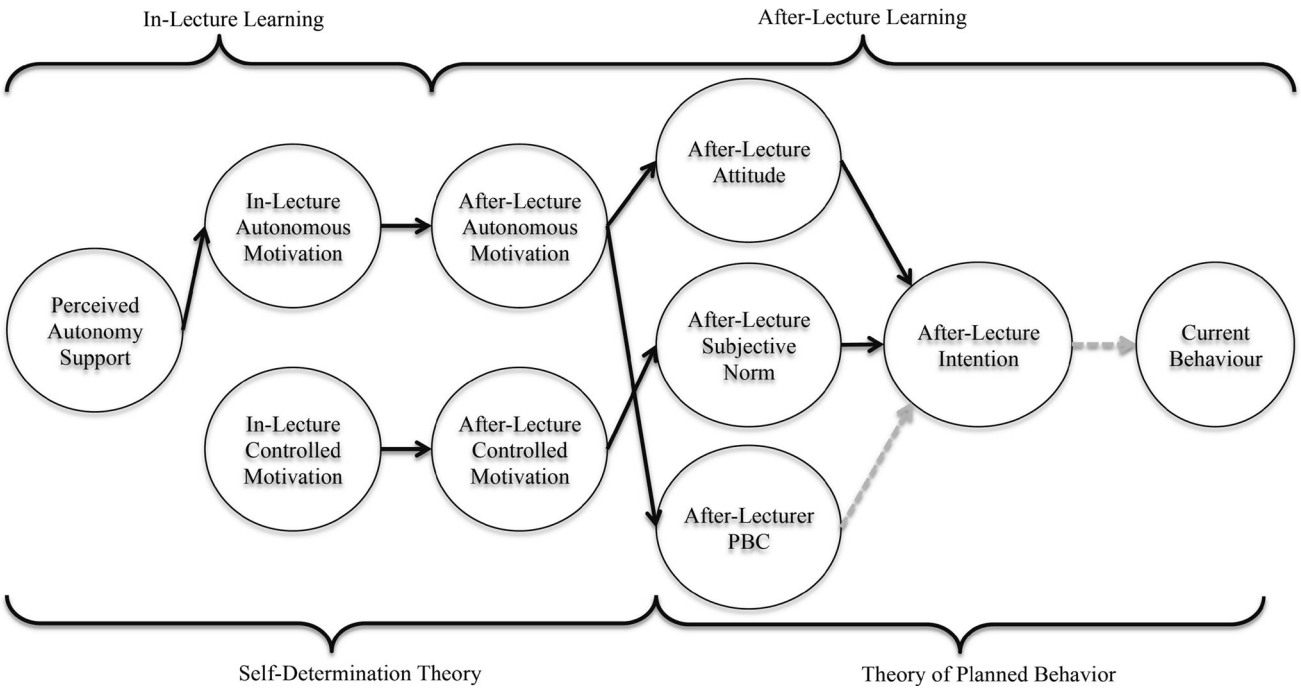

Fig. 1 Results of the mediation model tested in each sample. The black arrows represent positive parameter estimates that are consistent cross all the models. The broken lines indicate positive parameter estimates, but the strength of association in some Model (or countries) is not significant. Specifically, the position association between PBC and intention was significant apart from China (Model 3). The positive relationship between intention current-behaviour was only observed in the China, but not in UK and Pakistan samples. The paths between past-behaviour and all latent factors of the model are omitted for clarity reason

able to influence students' learning motives beyond the educational context. Specifically, if educators promote an autonomy supportive learning environment (McLachlan and Hagger 2010b; Reeve and Jang 2006), students are more likely to experience autonomous motivation in the educational context, which might contribute to a students being motivated to study out of their own interest and self-endorsed reasons in contexts outside University. Educators can promote autonomous motivation by explaining the reasons behind learning objectives, encouraging of task-relevant discussion, promoting self-initiated learning tasks, encouraging students' to set their own goals, acknowledging opinions and feelings, offering hints and support to help student overcome problems, and avoiding demanding instructions or using learning task as a way of punishment (Cheon and Reeve 2013; Cheon et al. 2012; Reeve and Jang 2006).

Promoting autonomous motivation toward after-lecture learning is important because, according to the TCM (Hagger and Chatzisarantis 2012; Hagger et al. 2003, 2005, 2009) and the literature on the integration of SDT and the theory of planned behaviour (Chan et al. 2015; Chan and Hagger 2012b; Hagger and Chatzisarantis 2009b), autonomous motivation is closely linked to the decision-making and planning process that underpins future engagement in behaviour. The results of the test of the TCM in all the three countries consistently revealed that autonomous motivation of after-lecture learning predicted attitudes and PBC for after-lecture learning behaviour, suggesting that students who engaged in after-lecture learning behaviour for autonomous reasons are more likely to make positive evaluations of, and believed they had personal control over, engaging in future learning behaviour. This is consistent with the proposed process in the model that autonomously motivated individuals are more likely to align their beliefs and intentions so that they are consistent with their motivations (Hagger and Chatzisarantis 2009b; Hagger et al. 2006a, b; McLachlan and Hagger 2010a). This is a strategic and adaptive process. Individuals who experience activities as autonomously motivated will identify those activities as ones likely to satisfy psychological needs. This will compel them to align their cognition (sets of beliefs) about the behaviour with their motivations so that they maximise the possibility that they will engage in the behaviour in future.

An unexpected finding in the current study was that autonomous motivation did not exhibit a positive link to subjective norm. Instead, subjective norm was predicted positively by controlled motivation, which was in the opposite direction to the proposition of the TCM (Hagger and Chatzisarantis 2012; Hagger et al. 2003, 2005) and the literature (Chan and Hagger 2012a, b). A plausible

Table 5 The results of mediation analysis

Path[a]	Direct effect	Combined effect	Indirect effect	Total effect
UK-Cross-sectional (Model 1)				
Support → After-Auto	.24**	.13**	.04*	.17**
Support → After-Cont	.08**	.08	.17**	.25*
In-Auto → Attitude	.41**	.21*	.13**	.34**
In-Auto → Norm	.24**	.17*	.02	.18*
In-Auto → PBC	.33**	.22**	.04**	.26**
In-Auto → Intention	.34**	−.06	.05**	.19*
In-Cont → Attitude	.10	.02	.00	.02
In-Cont → Norm	.26**	.11	.09	.19*
In-Cont → PBC	−.04	−.08	−.06	−.13
In-Cont → Intention	.09	.05	.00	.03
After-Auto → Intention	.58**	.19	.16**	.19**
After-Cont → Intention	.22**	−.02	.02	.03
UK-Prospective (Model 2)				
Support → After-Auto	.25**	.01	.13*	.14
Support → After-Cont	.17	−.02	.27**	.26*
In-Auto → Attitude	.38**	−.01	.20**	.19*
In-Auto → Norm	.12	.08	.05	.13
In-Auto → PBC	.26*	−.14	.14*	.00
In-Auto → Intention	.33**	−.04	.09	−.01
In-Auto → Curr-Behav	.39**	.17	.01	.21
In-Cont → Attitude	.11	.05	.00	−.05
In-Cont → Norm	.26*	.25*	−.04	.21
In-Cont → PBC	−.05	.26	−.15	.11
In-Cont → Intention	.09	−.26	−.05	−.16
In-Cont → Curr-Behav	.07	−.02	−.00	−.02
After-Auto → Intention	.49**	−.09	.18*	.10
After-Cont → Intention	.19	.05	−.06	.00
After-Auto → Curr-Behav	.48**	−.01	−.01	.13
After-Cont → Curr-Behav	.16	.04	−.00	.04
Attitude → Curr-Behav	.48**	.28*	.10*	.29*
Norm → Curr-Behav	.13	−.03	.01	−.02
PBC → Curr-Behav	.23*	.08	.02	.10
China-Prospective (Model 3)				
Support → After-Auto	.25**	.19*	.17*	.21*
Support → After-Cont	.17	.18	.13*	.54**
In-Auto → Attitude	.38**	.17	.05	.22
In-Auto → Norm	.12	.04	.07	.12
In-Auto → PBC	.26*	.17	.01	.18
In-Auto → Intention	.33**	.13	.04	.32*
In-Auto → Curr-Behav	.36**	.19	.01	.26
In-Cont → Attitude	.11	−.02	−.02	−.05
In-Cont → Norm	.26*	.08	.13*	.22
In-Cont → PBC	−.05	−.18	−.01	−.19
In-Cont → Intention	.09	.13	.04	.20
In-Cont → Curr-Behav	.34**	.27	.01	.30
After-Auto → Intention	.54**	.30	.10*	.39**
After-Cont → Intention	.31**	.13	.14*	.26**
After-Auto → Curr-Behav	.54**	.16	.01	.20
After-Cont → Curr-Behav	.43**	.03	.02	.07

Table 5 continued

Path[a]	Direct effect	Combined effect	Indirect effect	Total effect
Attitude → Curr-Behav	.36**	.28	.03	.00
Norm → Curr-Behav	.31**	.40	.05	.08
PBC → Curr-Behav	.25**	.12	.01	.05
Pakistan-Prospective (Model 4)				
Support → After-Auto	.24**	−.00	.13*	.12*
Support → After-Cont	.18	−.00	.31**	.30*
In-Auto → Attitude	.38*	.04	.18**	.22*
In-Auto → Norm	.10	.05	.04	.09
In-Auto → PBC	.24*	−.22	.11*	.11*
In-Auto → Intention	.33*	.00	.07	.09
In-Auto → Curr-Behav	.36**	.14	.06	.20*
In-Cont → Attitude	.11	−.06	.11	−.05
In-Cont → Norm	.29**	.28**	.02	.30*
In-Cont → PBC	.01	−.15	−.16	−.30
In-Cont → Intention	.05	−.21	.07	−.16
In-Cont → Curr-Behav	.04	−.02	.06	−.04
After-Auto → Intention	.49**	.09	.16*	.24*
After-Cont → Intention	.16	.09	−.03	.06
After-Auto → Curr-Behav	.48**	.01	−.02	.14*
After-Cont → Curr-Behav	.14	.06	−.01	.05
Attitude → Curr-Behav	.47**	.27*	.01	.28*
Norm → Curr-Behav	.13	−.05	.01	−.04
PBC → Curr-Behav	.21**	.08	.01	.09*

Support = perceived autonomy support from the lecturer; In-Auto = in-lecture autonomous motivation; In-Cont = in-lecture controlled motivation; After-Auto = after-lecture autonomous motivation; After-Cont = after-lecture controlled motivation; Norm = subjective norm; PBC = perceived behavioural control; Intention = intention; Past-Behav = past-behaviour; Curr-Behav = current-behaviour

** $p < .01$ at 2-tailed; * $p < .05$ at 2-tailed

[a] The mediators in the paths are not presented for clarity reasons. The paths are bolded when significant mediations are presented

explanation for this path is that individuals driven by controlled motivation seek to gain social approval (Deci and Ryan 2002) or to create an impression that they perceive to be acceptable to society (Leary and Kowalski 1990), so they are more likely to value the expectations, rules, or demands of significant others. As subjective norms reflect beliefs about the expectations of others it is not unexpected that this may reflect pressuring influences, which is consistent with controlled motives (Chan et al. 2015; Chan and Hagger 2012b). A number of previous studies have also reported a positive association between controlled motivation and subjective norm (Chan et al. 2014, 2015; Chan and Hagger 2012b). When social contexts place a strong emphasis on externally-referenced behavioural goals, controlled motivation is likely to be a strong behavioural driver because it matches the motivational climate typically engendered in that behavioural context (Vansteenkiste and Lens 2006).

In the context of University education, students' academic achievement is typically evaluated through coursework, exams, or projects, and in many cases, these evaluation tasks require students to spend hours of preparation and revision outside of the formal educational context. Obtaining good grades for course, not failing exams, graduating from the degree program, and making a good impression on significant others are predominantly salient beliefs about outcomes among University students for extra-mural studying behaviour (Frederiksen 1984). These beliefs, according to SDT, tend to be externally-referenced and controlling in nature, but are also highly valued by University students (Deci and Ryan 2000, 2002). Controlled motivation in this specific behavioural context could be a pervasive influence on motivation in educational context because it is closely matched with the competitive motivational climate that pervades in University academic contexts (Chan et al. 2014, 2015; Vansteenkiste and Lens

2006). This may explain why controlled motivation of after-lecture learning is positively correlated with subjective norm, intention, and behavioural adherence in our study. However, if the goal of education is to promote lifelong learning, independent thinking, and inquisitive behaviours, these motivational patterns are not ideal because when the controlling external contingencies are no longer relevant, students who do not endorse autonomous motivation for learning might be less likely to be motivated to continue learning the subject. Future research should scrutinise if the effect of controlled motivation in TCM could be long lasting, or its effectiveness only appears in certain education contexts or generally in the contexts where achievement or performance is highly valued.

In terms of the effects of culture on the TCM relations in the current study, there was considerable consistency in the effects across culture. However, the mediated pathway between controlled motivation and intention was only supported in the sample from China, and subjective norm was shown to be a significant mediator. It might be that the collectivistic culture in China that highlights interdependence and social values help internalise the controlled motivations in SDT. To Chinese students, controlled learning motivation might be less harmful as it somewhat aligns with social norm and group values that are highly regarded in their culture (Hagger et al. 2014; Tamis-LeMonda et al. 2008). Therefore, culture may play a role in moderating the effect of controlled motivation on students' after-lecture learning. Numerous researchers have discussed whether the need of autonomy is only evident in western societies (e.g., UK) because of their overarching individualist cultural orientation, and whether the potential benefits of autonomy support and autonomous motivation would be less important to eastern societies (e.g., China) because of their collectivist culture (Chirkov 2009; Vansteenkiste et al. 2005). However, Vansteenskiste and colleagues found similar effects of perceived autonomy support and autonomous motivation on adaptive psychological and behavioural outcomes, such as behavioural adherence and well-being, in Chinese immigrants living in Belgium and Belgian nationals of European ethnicity. However, there may have been an acculturation process for Chinese nationals living in a European country, meaning that they assimilated some or all of the cultural values of their adopted country. In contrast, our sample comprised Chinese participants who were born and living in China and likely represent a collectivist cultural group (Trafimow et al. 1991; Triandis 1989) relative to the Chinese immigrant population in Vansteenkiste et al.'s (2005) study. This may explain the discrepancies in the findings between our study and that of Vansteenkiste and coworkers. The collectivist cultural emphasis on group values, obedience, and respect (Hagger et al. 2014; Tamis-LeMonda et al. 2008) might also explain why the pathways of *autonomy support → in-lecture autonomous motivation* and *subjective norm → intention* were stronger in China than in the UK. Chinese students might be more likely to be influenced by the teaching style, values, and beliefs of significant others in the social environment.

Similarly, the relationship between PBC and intention was evident in data from the UK and Pakistan samples, but not the Chinese sample. The reason for this discrepancy may be due to cultural differences in the interpretation of academic achievement among students from the different national groups. Some research on implicit theories of ability and achievement motivation have documented that students in collectivist countries tend to attribute academic success to effort rather than ability relative to students from individualist countries (Bempechat and Drago-Severson 1999; Hau and Salili 1990; Markus and Kitayama 2003). Some Chinese students with lower PBC in learning might work even harder than other students in after-lecture revision because they believed that academic success could be achieved by putting extra-effort in study. This explanation required further research to support, but our findings tended to suggest that perceptions of control were less influential as a predictor of intentions for Chinese students than students in other countries due to the prevailing collectivist cultural norm in China.

Finally, the intention and behaviour link was only observed in China but not in other countries. The frequently-cited intention-behaviour gap (Sniehotta et al. 2005, 2014, 2015) was also present in our study, and cultural differences in terms of planning and action control might be a possible factor (Hagger and Luszczynska 2014). However, the variation in the intention-behaviour relations could be due to external factors such as academic term, exams, coursework that might have potentially inflated the error variance in our prospective measure of behaviour. Future studies should carefully control the discrepancies of these confounding factors on learning behaviours between national groups.

Practical recommendations

From a practical perspective, the pattern of results in the current study implies that the teaching style of lecturers is pivotal to students' after-lecture learning behaviour and academic outcomes. So it might be valuable for University lecturers to consider ways to support students' autonomous motivation during lecture time. Means to promote autonomous motivation from the TCM and SDT are to support students' psychological needs for autonomy, competence, and relatedness within the social environment i.e. during lecture time. Examples of an autonomy- or need-supportive environment include respecting students' views and

opinions, providing a meaningful rationale for studying, allowing time for students to work independently, offering encouragement and hints, and encouraging student-to-student or student-to-lecturer interactions (Reeve and Jang 2006). There are now comprehensive training programmes that have been shown to be effective in promoting better autonomy support by leaders and social agents (Chan et al. 2009, 2011; Cheon and Reeve 2013; Cheon et al. 2012; McLachlan and Hagger 2010b). These types of programmes would be the first step in developing skills for the delivery of interventions that will be effective in promoting better educational outcomes. We would also expect these programmes to be universally effective and generalisable. This is consistent with social cognitive theories and self-determination theory, which are conceptualised as generalised theories of behaviour and, therefore, should not vary across cultural contexts (Hagger et al. 2007; Hagger and Chatzisarantis 2015). A corollary of this is that means to promote autonomy support should also be effective across cultural contexts. We look to future research to ascertain the cultural and cross-national consistency of interventions adopting autonomy support interventions in a higher education context.

Limitation and future directions

A few limitations of this study should be identified to contextualise our findings and stimulate future research. First, the self-reported measures in the study raised issues of social desirability, self-report bias, and common-method effects. The assessment of behaviour should rely on more objective or other-reported methods (e.g., from parents or lecturers), and collecting students' academic performance (e.g., GPA, homework grades) may offer an objective evaluation of how motivation and behaviour are related to learning outcomes (Hagger et al. 2015), so these additional measures may be worth including in future studies.

Second, the three-wave prospective design somewhat reduced the issue of response consistency tendency (Chan and Hagger 2012d; Hagger et al. 2003), and, more importantly, allowed a prospective prediction of future behaviour when controlling for past behaviour. This design meant that we could explicitly model the unique effects of the psychological constructs on behaviour change independent of habit and automatic processes that are likely to be accounted for by the effects of past behaviour (Gardner 2015; Hagger et al. 2015; Rebar et al. 2015). However, future studies should adopt randomised controlled designs that test whether the manipulation of the autonomy support of lecturers may lead to changes in motivational, social cognitive, and behavioural outcomes proposed in the model (Hagger and Chatzisarantis 2009a, 2012). In addition, a longitudinal, cross-lagged panel design in which perceived autonomy support and autonomous motivation in both in-lecture and out-of-lecture contexts is measured would provide evidence as to whether there are reciprocal effects across contexts. Such evidence would be consistent with Vallerand's (2000) notion of interplay between forms of motivation in contexts and broaden and deepen the trans-contextual model.

Acculturation and globalisation may influence the cultural orientation of all countries, so we could not completely ascertain whether the sample from UK wholly endorsed the individualist cultural values that have tended to characterise the UK population (Chan et al. 2014). Similarly, we could also not definitively establish whether the Chinese and Pakistani participants held predominantly collectivist cultural values (Hagger et al. 2014). Future investigation may consider measuring participants' independent and interdependent of self-construals (Trafimow et al. 1991) to characterise the pervading cultural values adopted by participants in different national groups. Finally, data collection within each country was operated within single-subject classes of tertiary institutions, so the homogeneity of the sample might restrict the generalisability of the results. Further replications of the study should be conducted among secondary school pupils and students studying a wider variety of disciplines.

Conclusions

The present study was the first cross-cultural examination of the TCM in an educational setting. Results from the University students of UK, China, and Pakistan yielded findings that supported the propositions of the model, particularly the transfer of autonomous (i.e., self-determined) and controlled motivation across contexts. Results illustrated that perceived autonomy support from University lecturers is not only related to students' learning motivation in the lecture, but also to the quality and quantity of their motivation toward self-learning activities after the lecture, and the social-cognitive variables from the TPB and intentions to engage in future after-lecture educational activities.

Although there were some idiosyncratic differences in individual effects across samples, the overall picture was that the proposed pattern of effects in the TCM was supported. However, concerns remain over the relative weakness of the intention-behaviour relationship in two of the three samples, which opens to question whether interventions targeting the key motivational and social cognitive will engender actual behaviour change (Webb and Sheeran 2006).

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