

1 In-Lecture Learning Motivation Predicts Students' Motivation, Intention, and Behaviour for
2 After-Lecture Learning: Examining the Trans-Contextual Model across Universities from
3 UK, China, and Pakistan

4
5 Derwin King Chung Chan^{1, 3}

6 Sophie Xin Yang²

7 Takeshi Hamamura³

8 Sarwat Sultan^{3, 4}

9 Suxuan Xing⁵

10 Nikos L. D. Chatzisarantis³

11 Martin S. Hagger³

12
13 Author Note

14 ¹Institute of Human Performance, University of Hong Kong

15 ²Business School, Sichuan University, Chengdu, China.

16 ³School of Psychology and Speech Pathology, Curtin University, Perth, Australia.

17 ⁴School of Applied Psychology, Bahauddin Zakariya University Multan, Pakistan.

18 ⁵Chengdu Sport University, Chengdu, China

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21 Correspondence concerning this article should be addressed to Derwin K. C. Chan,
22 Institute of Human Performance, University of Hong Kong. Email: kc.derwin@gmail.com.

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29

Abstract

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

43

44 **Keywords:** self-determination theory; theory of planned behaviour; cross-cultural study; after-
45 class revision; self-efficacy; multi-group structural equation modeling.

46

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49 UK, China, and Pakistan

50 Adaptive teaching methods and styles of instruction, and a motivationally-appropriate
51 classroom environment, may not only facilitate students' learning behaviour within
52 educational contexts, but they may also foster students' independent learning behaviour in
53 contexts outside of the classroom (Ciani, Ferguson, Bergin, & Hilpert, 2010; Kolic-Vehovec,
54 Roncevic, & Bajanski, 2008). One important goal for educators, therefore, is to foster
55 students' capacity to apply the skills and concepts learned in the classroom toward self-
56 directed learning activities outside the classroom. It is widely accepted in the educational
57 research literature that the behaviour of significant social agents (e.g., teachers, lecturers) in
58 educational settings has major influences on students' after-school learning and skill-
59 development (Kolic-Vehovec et al., 2008; Pugh, Linnenbrink-Garcia, Koskey, Stewart, &
60 Manzey, 2010; Tomasetto, 2004). However, little is known about the psychological processes
61 by which the behavioural patterns of educators in educational contexts relate to students'
62 learning motivation and behaviour outside educational environments (Hagger &
63 Chatzisarantis, 2012).

64 A recently-developed social psychological model, the trans-contextual model (Hagger,
65 Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005; Hagger, Chatzisarantis, Culverhouse,
66 & Biddle, 2003), has received increasing attention. It is proposed as a feasible framework for
67 explaining relations between the perceived behaviours of educators and students' motivation
68 and behaviour toward educational activities across the education and extramural settings
69 (Hagger & Chatzisarantis, 2012, 2015). The purpose of the present study is to evaluate a
70 preliminary application of the trans-contextual model in a University education context to
71 explain the process by which perceived autonomy support (i.e., the provision of rationales,

72 choices, care, and competence support to students) from lecturers (Black & Deci, 2000; Reeve
73 & Jang, 2006) links to students' motivational, social cognitive, and behavioural factors of
74 learning after the lecture, across three different countries (i.e., UK, China, and Pakistan). The
75 research is expected to contribute to knowledge by investigating whether students' perception
76 of the autonomy support offered by their lecturers is related to their motivation for
77 educational activities in the educational context, and, most importantly, their motivation and
78 actual behaviour for such activities in an extramural context.

79 **The Trans-Contextual Model**

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

94 The organismic and dialectical perspective endorsed by SDT postulates that people
95 have an innate tendency to overcome challenges, derive interest and enjoyment, and explore
96 their potential in the activities they pursue (Deci & Ryan, 2000, 2002). Central to the theory is

97 the construct of self-determined or *autonomous* motivation. This form of motivation is
98 considered adaptive because it accounts for the quality, rather than merely the quantity, of
99 motivation by identifying the reasons why individuals engage in particular behaviours (Deci
100 & Ryan, 2000, 2002). Specifically, individuals endorse autonomous motivation when they
101 perform activities for personally-valued goals and to attain self-endorsed outcomes. In
102 contrast, *controlled* motivation is defined as engaging in activities for external contingencies
103 (e.g., gaining reward, avoiding punishment) or ego involvement (e.g., gaining recognition and
104 approvals from others, or avoiding internal feelings of guilty and shame). Autonomous
105 motivation, as posited by SDT, is associated with more adaptive psychological and
106 behavioural outcomes such as well-being and persistence because it is consonant with
107 individuals' innate psychological needs for autonomy, competence, and relatedness. These
108 needs are considered basic and universal and the satisfaction of the needs, particularly the
109 need for autonomy, is considered fundamental to optimal functioning and psychological well-
110 being (Deci & Ryan, 2000, 2002; Sheldon, Elliot, Kim, & Kasser, 2001). The needs provide
111 the basis for motivational styles in given contexts and it is the satisfaction of psychological
112 needs that serves as the 'nutriment' of future behavioural engagement (Deci & Ryan, 2000).
113 In contrast, controlled motivation is associated with maladaptive psychological and
114 behavioural outcomes such as negative affect and behavioural desistance because it is
115 incongruent with psychological needs.

116 The fundamental proposition of the TCM, that is, the transfer of motivation across
117 contexts, is derived from tenets of Vallerand's (2000) hierarchical model of motivation.
118 Vallerand's hierarchical model extends SDT by specifying that motivation operates at
119 different levels (global, contextual, and situational) and varies over time. Based on
120 Vallerand's corollary in the hierarchical model that there will be interplay between
121 motivational styles from SDT at the contextual level, a key premise in the TCM is that self-

122 determined motivation is transferable from a primary context (e.g., education) to self-
123 determined motivation in a secondary context (e.g., extra-mural) that is closely related to the
124 primary one. This trans-contextual process of motivation might explain how autonomy
125 support from teachers is indirectly related to students' learning motivation outside school via
126 learning motivation in the classroom (Hagger & Chatzisarantis, 2012). Hagger and
127 Chatzisarantis (2015) propose that the process underpinning the trans-contextual motivational
128 effect relates to the motivational schema or script developed by experiences of motivation in
129 the primary context. This motivational script is stored in memory and provides an action
130 pattern or template for action when cues that signal opportunities for like behaviours to be
131 enacted become salient.

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

144 Specifically, the TCM proposes a motivational sequence in which self-determined
145 motivation is related to behaviour indirectly, mediated by the social cognitive variables and
146 intention from the theory of planned behaviour (Ajzen, 1985, 2015). Self-determined

147 motivation is proposed to positively predict the social cognitive variables (Hagger &
148 Chatzisarantis, 2012, 2015), including attitude (i.e., general beliefs that the behaviour will
149 lead to desirable outcomes), subjective norm (i.e., perceptions of significant others' approval
150 of performing the behaviour), and perceived behavioural control (PBC; i.e., the perception of
151 ability, capacity, and resources to keep the behaviour under control). While SDT and theory
152 of planned behaviour occupy different epistemological perspectives, the integration of the two
153 perspectives is based on the original premise proposed by Deci and Ryan (1985) that
154 individuals will tend to align their social cognitive beliefs about future behavioural
155 engagement with their motivation. If individuals have experienced a behaviour as one that is
156 driven by high autonomous motivation and low controlled motivation, it will be identified as
157 one that has the potential to satisfy psychological needs. The individual will then be
158 compelled to seek out that behaviour in order to satisfy the need in future. In order to do so,
159 he or she would need to strategically align their beliefs and intentions with respect to
160 engaging in the need-satisfying behaviour in future. As a consequence, the beliefs will
161 correspond with the individual's motivation. Incorporating the constructs from the theory of
162 planned behaviour into the TCM, therefore, provides a formal means to test the process by
163 which motivation in both educational and extra-mural contexts are associated with future
164 behaviour in the extra-mural context (Hagger & Chatzisarantis, 2015; Hagger, Sarwat,
165 Hardcastle, & Chatzisarantis, 2015).

166 Research has provided evidence that individual motives align closely with their
167 behavioural beliefs (Hagger, Chatzisarantis, & Harris, 2006a, 2006b; McLachlan & Hagger,
168 2010a, 2011). Consistent with hypotheses from the theory of planned behaviour, the three
169 social cognitive variables are hypothesised to form positive associations with behaviour
170 mediated by intention (Ajzen, 1985, 2015). Research testing the theoretical integration
171 between self-determination theory and the theory of planned behaviour has supported the

172 proposed motivational sequence, showing that motivation is a distal predictor of behaviour
173 mediated by constructs from the theory of planned behaviour (Chan, Fung, Xing, & Hagger,
174 2014; Chan & Hagger, 2012c; Chan, Yang, et al., 2014; Hagger & Chatzisarantis, 2009b).

175 **Support for the TCM**

176 A growing number of studies have tested the hypotheses of the TCM, primarily in physical
177 education (PE) settings. After the initial validation of the TCM conducted among UK PE
178 students (Hagger et al., 2003), further replications have been conducted cross-culturally in
179 samples from the Greece, Poland, Singapore, Hungary, Finland, and Estonia, supporting the
180 application of TCM in PE settings and its cross-cultural generalisability (Hagger et al., 2005,
181 2009). There have also been applications of the model to explain the trans-contextual process
182 of motivation in other health-related domains including rehabilitation (Chan, Hagger, &
183 Spray, 2011), injury prevention (Chan & Hagger, 2012a, 2012d), and anti-doping (Chan et al.,
184 2015). Recent meta-analyses and narrative reviews have also demonstrated support for the
185 fundamental premises of the TCM in multiple samples and from multiple research groups
186 (Hagger & Chatzisarantis, 2012, 2015).

187 To date, only one study has applied the TCM to explain the process by which self-
188 determined motivation toward learning in school is related to motivation toward after-school
189 learning behaviour. Hagger, Sarwat, Hardcastle, and Chatzisarantis (2015) examined the
190 TCM among high school students' learning behaviour from Pakistan. It was found that
191 autonomous motivation for participating in in-school mathematics activities was predicted
192 positively by perceived autonomy support from mathematics teachers. Further, autonomous
193 motivation toward in-school mathematics activities was a positive predictor of autonomous
194 motivation toward after-school math homework. Intention to engage in mathematics
195 homework was positively predicted by autonomous motivation for doing after-school
196 mathematics homework mediated by the social cognitive factors, and was a positive predictor

197 of prospective indices of behavioural adherence including mathematics homework completion
198 and homework grades (Hagger, Sarwat, et al., 2015). This initial evidence showed that TCM
199 can also explain the motivational processes that underpin students' academic behaviour and
200 academic performance.

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

219 Importantly, theorists have proposed that the TCM and its component models and
220 theories propose processes that are expected to represent generalisable patterns of action that
221 will likely be consistent regardless of cultural group (Chirkov, 2009; Hagger &

222 Chatzisarantis, 2015; Hagger et al., 2007). This is because theories of motivation like self-
223 determination theory and theories of social cognition like the theory of planned behaviour
224 assume that the motivational and information processes that underpin their predictions are
225 consistent across individuals and, therefore, independent of cultural norms. There is some
226 support for these assumptions in previous cross-cultural research on self-determination theory
227 (Chirkov, 2009; Hagger & Chatzisarantis, 2011), the theory of planned behaviour (Bagozzi,
228 Lee, & Van Loo, 2001; Hagger et al., 2007), and the TCM (Hagger et al., 2005; Hagger et al.,
229 2009) with indications that the general patterns of prediction tend to be largely replicated.
230 This support notwithstanding, the relative strength of the predictions may vary across culture.
231 This has paved the way for calls to examine and confirm the cross-cultural generalisability of
232 the proposed patterns of prediction proposed in models of motivation.

233 **The Present Study**

234 The purpose of the present study was to test the propositions of the TCM in University
235 students from three countries: the UK, China, and Pakistan. These countries were selected
236 because of their specific cultural characteristics. UK is a good example of a national group
237 that tends to endorse individualist cultural orientations, while China is typically regarded as
238 country that adopts a predominantly collectivist orientation (Hofstede et al., 2010; Triandis,
239 1989, 1995). People from Pakistan tend to adopt a collectivist cultural orientation according
240 to Hofstede et al. (2010), and this is the cultural context in which the TCM has been applied
241 to an academic context. However, based on the premise of the universality and
242 generalisability of the proposed effects in the TCM (Hagger & Chatzisarantis, 2012, 2015;
243 Hagger et al., 2005), we proposed that the propositions of the TCM would be applicable in all
244 three national samples to explain the trans-contextual transfer of motivation. We therefore
245 expected that the proposed pattern of effects outlined in the motivational sequence of the
246 TCM would be invariant across the groups. Specifically, we predicted that:

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

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

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

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

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

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

264 **Method**

265 **Participants**

266 Participants were undergraduate students recruited from three Universities located in
267 the UK, China, and Pakistan. Data from the UK sample ($N = 245$; M age = 19.49, $SD = 1.46$;
268 26.53% male) comprised undergraduate psychology students from the University of
269 [institution name masked for blind review]. According to the statistics of the institution, the
270 ethnicity of the majority (87% in 2009) of the students is white Caucasian, which is consistent
271 with the overall ethnicity distribution in the UK. The sample from China ($N = 107$; M age =

272 20.14, $SD = 2.98$; 79.44% male) comprised undergraduate students enrolled in a sport
273 psychology course in the University of [name masked for blind review]. Participants were all
274 of Chinese ethnicity. Data from the Pakistan sample ($N = 90$; M age = 19.45, $SD = 1.26$;
275 23.33% male) was obtained from University of [name masked for blind review] and
276 comprised students enrolled in a health psychology course. Participants were all of Pakistan
277 ethnicity. In all the courses, students were asked to complete coursework, projects, and
278 examinations. Each week, participants were required to attend an average of two course
279 lectures (class size approximately one hundred students), each lasting approximately ninety
280 minutes, organised and led their lecturers. They also spent time revising their lecture notes or
281 reading course materials (UK = 1.54 hours, $SD = 2.09$; China = 3.57 hours, $SD = 2.99$;
282 Pakistan = 1.60 hours, $SD = 2.09$) and doing coursework (UK = 2.46 hours, $SD = 3.43$; China
283 = 2.02 hours, $SD = 2.28$; Pakistan = 2.59 hours, $SD = 3.51$).

284 **Procedure**

285 The present study adopted a three-wave prospective survey design identical in design
286 to previous studies testing the TCM (Hagger et al., 2005; Hagger et al., 2003). In the first
287 wave of data collection, participants were asked to complete items relating to their
288 demographic details, scales of perceived autonomy support, and in-lecture learning
289 motivation. One week later, participants completed the second survey that comprised
290 measures of autonomous and controlled forms of motivation, the social cognitive variables
291 and intention from the theory of planned behaviour, and behavioural adherence for after-
292 lecture learning activities. The one-week latency period between the first two waves of data
293 collection was adopted to reduce the common method variance associated with the use of
294 similar methods to measure constructs based on SDT (Hagger et al., 2005; Hagger et al.,
295 2003). Five weeks after the first wave, participants completed a third wave of data collection
296 comprising measures of behavioural adherence toward after-lecture learning activities. The

297 latency period between wave 2 and wave 3 allowed a five-week prospective prediction of
298 behavioural adherence by the psychological and behavioural constructs. Participants were
299 reminded that they were to refer to the same course or subject (hence, the same lecturer) when
300 responding to the survey items.

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

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

316 **Measures**

317 **Perceived Autonomy Support.** The six-item short version of the Learning Climate
318 Questionnaire (Black & Deci, 2000) was used to measure students' perception of autonomy
319 support by their lecturer in the first wave of data collection. The scale items were adapted to
320 refer to "my lecturer" and participants were required to rate how true each of six the

321 statements was as a description of their lecturer's autonomy supportive behaviours on a
322 seven-point Likert scales. Full details of the scale are provided in Appendix A.

323 **Student Motivation.** Students' learning motivation was evaluated using an adapted
324 version of Academic Self-Regulation Questionnaire (ASRQ; Black & Deci, 2000) in the first
325 wave of data collection. For students' in-lecture learning motivation, we adapted sixteen items
326 of the scale by modifying the common item stem so that it made reference to behaviours in
327 the specific context: "I try to take notes and to listen attentively in lectures because...".
328 Similarly, sixteen items from the ASRQ were adapted to measure student motivation for
329 after-lecture learning in the second wave of data collection. We modified the common item
330 stem to be context-appropriate: "I revise and study the subject after lectures because..." Items
331 measuring autonomous (i.e., intrinsic motivation and identified regulation) and controlled
332 (i.e., extrinsic and introjected regulation) forms of motivation were taken directly from the
333 original version of ASRQ. Participants rated the extent to which they agreed with the items on
334 seven-point Likert-scales.

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

340 **Behavioural Adherence.** We adapted seven items from a previous study measuring
341 students' effort for doing homework or revising for mathematics lessons after-school
342 (Trautwein, 2007) to measure after-lecture learning. Participants reported how much effort
343 they invested in after-lecture learning (i.e., doing coursework and studying) on a seven-point
344 Likert-type scales. The measure was administered at wave 3 and constituted our target
345 outcome variable. However, we also administered the measure at wave 2 to measure past-

346 behaviour. The inclusion of a measure of past-behaviour is recommended by Hagger and
347 colleagues (Hagger et al., 2003, 2009, 2015) to evaluate whether the predicted paths of the
348 TCM would hold after controlling the effect of past behaviour. This is an important endeavor
349 of any social psychological and motivational model because it is important that the
350 hypothesised effects of motivational variables on behaviour remain after accounting for
351 previous experience. If the model variables fail to explain any unique variance in behaviour,
352 then it suggests that habit or behavioural frequency is the sole determinant of behaviour
353 rendering the model redundant as it provides no explanatory value above past behavioural
354 frequency (Ajzen, 2002b; Ouellette & Wood, 1998). In such cases behaviour may either be a
355 function of habitual or automatic processes or some other unmeasured constructs unaccounted
356 for by the redundant model (Gardner, 2015; Hagger, Rebar, Mullan, Lipp, & Chatzisarantis,
357 2015; Rebar, Loftus, & Hagger, 2015).

358 **Analysis**

359 In order to test the hypotheses of the TCM and its cross-cultural invariance, variance-
360 based structural equation modeling (VB-SEM) was employed using the WarpPLS 4.0
361 statistical software (Kock, 2013). Unlike covariance-based structural equation modeling (CB-
362 SEM) that has specific requirements for sample size and normality of the data, VB-SEM
363 estimates the goodness of fit and parameter estimates of the model using a distribution-free
364 algorithm, namely partial least-squares. Hair, Sarstedt, Ringle, and Mena (2012) suggested
365 that VB-SEM could be employed in conjunction with CB-SEM, and the sample size and
366 number of indicator should be increased to infinite for an error-free estimation of latent
367 factors. However, statistical power analysis (Chan, 2009; MacCallum, Browne, & Sugawara,
368 1996) showed that the sample size in the datasets was not sufficiently large for supporting
369 CB-SEMs. The sample size of our smallest sample indeed exceeded the minimum sample size
370 requirements for running VB-SEMs for our hypothesised model (Barclay, Thompson, &

371 Higgins, 1995), so VB-SEM, instead of CB-SEM, was conducted for our study. The partial
372 least-squares estimation method is able to construct error-free latent factors without placing
373 any assumption on the sampling distribution, model estimation was assumed to be unaffected
374 by small sample size or complex model structure (Reinartz, Haenlein, & Henseler, 2009),
375 making it ideal for the present investigation.

376 In VB-SEM, the convergent and discriminant validity of the model are typically
377 considered acceptable when factor loadings ($>.70$, and $>$ all cross-loadings), averaged
378 variance extracted (AVE; $>.50$), composite score reliability ($>.70$), and Cronbach's alpha
379 ($>.70$), and square-root of AVE ($>$ mean factor-to-factor correlation) exceed the proposed
380 criteria (Barclay et al., 1995; Chin, 1998; Henseler, Ringle, & Sinkovics, 2009). The global fit
381 of the model is acceptable when the Goodness-of-fit index (GoF; $>.25$), averaged variance
382 inflation factor (AVIF; <5), averaged full collinearity VIF (AFVIF; <5), averaged R-squared
383 (ARS; $<.05$), and averaged path coefficient (APC; $<.05$) meet the criteria for acceptable
384 goodness-of-fit (Tenenhaus, Vinzi, Chatelin, & Lauro, 2005; Wetzels, Odekerken-Schroder,
385 & van Oppen, 2009).

386 To ensure the stability of model in data from the UK, China, and Pakistan samples, we
387 used a bootstrapping resampling technique with 999 replications (the maximum number of
388 replications permitted in WarpPLS) to produce the averaged path estimates in the structural
389 model. In addition, we conducted mediation analyses for all possible mediation pathways
390 within the TCM. Mediation was confirmed when the indirect and total effects were
391 statistically significant (Hayes, 2009; Zhao, Lynch, & Chen, 2010). In the present study, we
392 used the UK sample as our reference group, and we tested the initial measurement and
393 structural models of the TCM in data from the UK sample ($N = 245$) who completed the first
394 two waves of measurement. This baseline model (Model 1) included all the factors in the
395 TCM apart from the behavioural adherence measure in the third wave of data collection. The

396 purpose of this initial model was to utilise the full UK dataset to examine the factorial validity
397 and internal consistency of the study measures before we conducted further analysis. In
398 particular, the model comprised all the factors and structural pathways among the perceived
399 autonomy support, in-lecture learning motivation, after-lecture learning motivation, social
400 cognitive factors, and intention factors. Past behaviour (i.e., behavioural adherence measured
401 in the second wave of data collection) was included as a control variable¹ and set to predict all
402 other factors in the model (Hagger et al., 2003, 2005).

403 When the psychometric properties of the baseline model were confirmed, we included
404 our measure of after-lecture learning behaviour in subsequent tests of the full TCM in the
405 prospective datasets from the UK (Model 2; N = 87; the participants who completed the
406 survey across all three waves), China (Model 3; N = 107), and Pakistan (Model 4; N = 90).
407 Current behaviour was estimated as a latent factor predicted by intention and past behaviour.
408 As such, the intention-behaviour pathway could reveal the extent to which intention was
409 predictive of behaviour change over the five-week period. We used the multi-group VB-SEM
410 protocol proposed by Sarstedt, Henseler, and Ringle (2011) to examine the invariance of the
411 model pathways between Model 2, Model 3, and Model 4. Particularly, we used the omnibus
412 test of group differences to review the overall difference of each path estimate between
413 Models 2 to 4. When the variance ratio (i.e., the ratio between between-subject and within-
414 subject sum of squares) was significant (i.e., $p < .05$), we concluded that the path estimate was
415 significantly different across the UK, China, and Pakistan groups. We also employed
416 Henseler's (2012) non-parametric test to make comparisons of the parameter estimates
417 between each pair of national groups (Henseler, 2012; Sarstedt et al., 2011). Sarstedt and

¹We 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.

418 colleagues (2011) recommend that a reasonable number of bootstrapped estimates (e.g., 5000)
419 be generated to ensure robust multi-group VB-SEM comparisons. As WarpPLS 4.0 could
420 only handle up to 999 bootstrapped replications (Kock, 2013), we used SmartPLS-M3
421 (Ringle, Wende, & Will, 2005) to export 5000 bootstrapped values for each parameter
422 estimate in the model for the omnibus test and Henseler's (2012) non-parametric test.

423 **Results**

424 **Measurement Level Analysis**

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

437 **Structural Level Analysis**

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

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

442 (H2) In-lecture autonomous motivation significantly and positively predicted after-
443 lecture autonomous motivation, but not after-lecture controlled motivation. In-lecture
444 controlled motivation positively and significantly predicted after-lecture controlled motivation
445 but not after-lecture autonomous motivation.

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

449 (H4) Attitudes, subjective norms, and PBC were significantly and positively
450 associated with intention in all countries, apart from a non-significant association between
451 PBC and intention in China. Mediation analysis showed that the social cognitive variables
452 that correlated intention significantly mediated the relationship between autonomous
453 motivation and intention of after-lecture learning activity. The relationship between controlled
454 motivation and intention of after-lecture learning activity was mediated by subjective norm
455 only in the sample of China, and the proposed mediation pathway for controlled motivation
456 was not supported in other samples.

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

460 **Cross-Cultural Comparisons**

461 Henseler's (2012) invariance test revealed few significant differences in the size of
462 paths across the three countries. Specifically, the perceived autonomy support → in-lecture
463 autonomous motivation, and the subjective norm → intention paths were stronger in China
464 than in UK. The in-lecture controlled motivation → after-lecturer controlled motivation was
465 stronger in Pakistan than in China. Figure 1 displays a summary of the path estimates of all
466 models and the results of the multi-group analysis. The results of the mediation analysis are

467 mixed between different models. In general, only three mediation pathways (i.e., perceived
468 autonomy support → after-lecture autonomous motivation, perceived autonomy support →
469 after-lecture controlled motivation, and after-lecture autonomous motivation → intention)
470 were shown to be statistically significant and consistent across samples, other significant
471 mediation pathways were only observed for some models (see Table 5 for details).

472 **Discussion**

473 We applied the TCM to investigate the motivational and social cognitive predictors of
474 after-lecture learning behaviour in University students in three different countries. Our results
475 supported the main premises of the model in a higher-education context for the first time with
476 consistency in the pattern of effects across the three samples. When students perceived that
477 their lecturers supported their autonomy they were more likely to endorse autonomous
478 motivation for learning in the lecture and, critically, more likely to endorse autonomous
479 motivation toward after-lecture learning activities. On the other hand, when students held high
480 controlled motivation toward learning in the lecture, they were more likely to endorse
481 controlled motivation toward learning after the lecture. This pattern of results is consistent
482 with the tenets of the TCM (Hagger & Chatzisarantis, 2012, 2015; Hagger et al., 2003;
483 Hagger et al., 2009) and the findings of a previous application of the TCM to investigate
484 secondary school students' mathematics learning outside of school (Hagger, Sarwat, et al.,
485 2015). It illustrates that the motivational sequence proposed in the model provides a basis to
486 explain the process by which motivation transfers from the lecture room to home-based
487 learning contexts. Findings imply that the potential effects of lecturers' autonomy support are
488 exerted not only on students' in-lecture motivation for learning, but also on students'
489 motivation for educational activities after the lecture.

490 This promising finding also provides an indication as to how teaching style or
491 methods adopted by educators in an educational context affect students' motives to learn

492 outside of the educational context (Ciani et al., 2010; Kolic-Vehovec et al., 2008). If the
493 primary goal of tertiary education is to engender motivation to engage in independent self-
494 study and promote students' capacity to cope with the academic demands outside the formal
495 education context (Kolic-Vehovec et al., 2008; Pugh et al., 2010; Tomasetto, 2004), the trans-
496 contextual process of motivation would provide a feasible explanation of how lecturers or
497 teachers could foster students' initiative and adaptive behavioural patterns for self-directed
498 learning after-school (Hagger & Chatzisarantis, 2012). Consistent with the TCM (Hagger &
499 Chatzisarantis, 2012), the findings of the present study provide some indication that lecturers
500 or teachers may be able to influence students' learning motives beyond the educational
501 context. Specifically, if educators promote an autonomy supportive learning environment
502 (McLachlan & Hagger, 2010b; Reeve & Jang, 2006), students are more likely to experience
503 autonomous motivation in the educational context, which might contribute to a students being
504 motivated to study out of their own interest and self-endorsed reasons in contexts outside
505 University. Educators can promote autonomous motivation by explaining the reasons behind
506 learning objectives, encouraging of task-relevant discussion, promoting self-initiated learning
507 tasks, encouraging students' to set their own goals, acknowledging opinions and feelings,
508 offering hints and support to help student overcome problems, and avoiding demanding
509 instructions or using learning task as a way of punishment (Cheon & Reeve, 2013; Cheon,
510 Reeve, & Moon, 2012; Reeve & Jang, 2006).

511 Promoting autonomous motivation toward after-lecture learning is important because,
512 according to the TCM (Hagger & Chatzisarantis, 2012; Hagger et al., 2005; Hagger et al.,
513 2003; Hagger et al., 2009) and the literature on the integration of SDT and the theory of
514 planned behaviour (Chan et al., 2015; Chan & Hagger, 2012b; Hagger & Chatzisarantis,
515 2009b), autonomous motivation is closely linked to the decision-making and planning process
516 that underpins future engagement in behaviour. The results of the test of the TCM in all the

517 three countries consistently revealed that autonomous motivation of after-lecture learning
518 predicted attitudes and PBC for after-lecture learning behaviour, suggesting that students who
519 engaged in after-lecture learning behaviour for autonomous reasons are more likely to make
520 positive evaluations of, and believed they had personal control over, engaging in future
521 learning behaviour. This is consistent with the proposed process in the model that
522 autonomously motivated individuals are more likely to align their beliefs and intentions so
523 that they are consistent with their motivations (Hagger & Chatzisarantis, 2009b; Hagger et al.,
524 2006a, 2006b; McLachlan & Hagger, 2010a). This is a strategic and adaptive process.
525 Individuals who experience activities as autonomously motivated will identify those activities
526 as ones likely to satisfy psychological needs. This will compel them to align their cognition
527 (sets of beliefs) about the behaviour with their motivations so that they maximise the
528 possibility that they will engage in the behaviour in future.

529 An unexpected finding in the current study was that autonomous motivation did not
530 exhibit a positive link to subjective norm. Instead, subjective norm was predicted positively
531 by controlled motivation, which was in the opposite direction to the proposition of the TCM
532 (Hagger & Chatzisarantis, 2012; Hagger et al., 2005; Hagger et al., 2003) and the literature
533 (Chan & Hagger, 2012a, 2012b). A plausible explanation for this path is that individuals
534 driven by controlled motivation seek to gain social approval (Deci & Ryan, 2002) or to create
535 an impression that they perceive to be acceptable to society (Leary & Kowalski, 1990), so
536 they are more likely to value the expectations, rules, or demands of significant others. As
537 subjective norms reflect beliefs about the expectations of others it is not unexpected that this
538 may reflect pressuring influences, which is consistent with controlled motives (Chan et al.,
539 2015; Chan & Hagger, 2012b). A number of previous studies have also reported a positive
540 association between controlled motivation and subjective norm (Chan et al., 2015; Chan,
541 Donovan, et al., 2014; Chan & Hagger, 2012b). When social contexts place a strong emphasis

542 on externally-referenced behavioural goals, controlled motivation is likely to be a strong
543 behavioural driver because it matches the motivational climate typically engendered in that
544 behavioural context (Vansteenkiste & Lens, 2006).

545 In the context of University education, students' academic achievement is typically
546 evaluated through coursework, exams, or projects, and in many cases, these evaluation tasks
547 require students to spend hours of preparation and revision outside of the formal educational
548 context. Obtaining good grades for course, not failing exams, graduating from the degree
549 program, and making a good impression on significant others are predominantly salient
550 beliefs about outcomes among University students for extra-mural studying behaviour
551 (Frederiksen, 1984). These beliefs, according to SDT, tend to be externally-referenced and
552 controlling in nature, but are also highly valued by University students (Deci & Ryan, 2000,
553 2002). Controlled motivation in this specific behavioural context could be a pervasive
554 influence on motivation in educational context because it is closely matched with the
555 competitive motivational climate that pervades in University academic contexts (Chan et al.,
556 2015; Chan, Donovan, et al., 2014; Vansteenkiste & Lens, 2006). This may explain why
557 controlled motivation of after-lecture learning is positively correlated with subjective norm,
558 intention, and behavioural adherence in our study. However, if the goal of education is to
559 promote life-long learning, independent thinking, and inquisitive behaviours, these
560 motivational patterns are not ideal because when the controlling external contingencies are no
561 longer relevant, students who do not endorse autonomous motivation for learning might be
562 less likely to be motivated to continue learning the subject. Future research should scrutinise
563 if the effect of controlled motivation in TCM could be long lasting, or its effectiveness only
564 appears in certain education contexts or generally in the contexts where achievement or
565 performance is highly valued.

566 In terms of the effects of culture on the TCM relations in the current study, there was
567 considerable consistency in the effects across culture. However, the mediated pathway
568 between controlled motivation and intention was only supported in the sample from China,
569 and subjective norm was shown to be a significant mediator. It might be that the collectivistic
570 culture in China that highlights interdependence and social values help internalise the
571 controlled motivations in SDT. To Chinese students, controlled learning motivation might be
572 less harmful as it somewhat aligns with social norm and group values that are highly regarded
573 in their culture (Hagger et al., 2014; Tamis-LeMonda et al., 2008). Therefore, culture may
574 play a role in moderating the effect of controlled motivation on students' after-lecture
575 learning. Numerous researchers have discussed whether the need of autonomy is only evident
576 in western societies (e.g., UK) because of their overarching individualist cultural orientation,
577 and whether the potential benefits of autonomy support and autonomous motivation would be
578 less important to eastern societies (e.g., China) because of their collectivist culture (Chirkov,
579 2009; Vansteenkiste, Zhou, Lens, & Soenens, 2005). However, Vansteenskiste and colleagues
580 found similar effects of perceived autonomy support and autonomous motivation on adaptive
581 psychological and behavioural outcomes, such as behavioural adherence and well-being, in
582 Chinese immigrants living in Belgium and Belgian nationals of European ethnicity. However,
583 there may have been an acculturation process for Chinese nationals living in a European
584 country, meaning that they assimilated some or all of the cultural values of their adopted
585 country. In contrast, our sample comprised Chinese participants who were born and living in
586 China and likely represent a collectivist cultural group (Trafimow, Triandis, & Goto, 1991;
587 Triandis, 1989) relative to the Chinese immigrant population in Vansteenkiste et al.'s (2005)
588 study. This may explain the discrepancies in the findings between our study and that of
589 Vansteenkiste and coworkers. The collectivist cultural emphasis on group values, obedience,
590 and respect (Hagger et al., 2014; Tamis-LeMonda et al., 2008) might also explain why the

591 pathways of *autonomy support* → *in-lecture autonomous motivation* and *subjective norm* →
592 *intention* were stronger in China than in the UK. Chinese students might be more likely to be
593 influenced by the teaching style, values, and beliefs of significant others in the social
594 environment.

595 Similarly, the relationship between PBC and intention was evident in data from the
596 UK and Pakistan samples, but not the Chinese sample. The reason for this discrepancy may
597 be due to cultural differences in the interpretation of academic achievement among students
598 from the different national groups. Some research on implicit theories of ability and
599 achievement motivation have documented that students in collectivist countries tend to
600 attribute academic success to effort rather than ability relative to students from individualist
601 countries (Bempechat & Drago-Severson, 1999; Hau & Salili, 1990; Markus & Kitayama,
602 2003). Some Chinese students with lower PBC in learning might work even harder than other
603 students in after-lecture revision because they believed that academic success could be
604 achieved by putting extra-effort in study. This explanation required further research to support,
605 but our findings tended to suggest that perceptions of control were less influential as a
606 predictor of intentions for Chinese students than students in other countries due to the
607 prevailing collectivist cultural norm in China.

608 Finally, the intention and behaviour link was only observed in China but not in other
609 countries. The frequently-cited intention-behaviour gap (Sniehotta, Pesseau, & Araújo-
610 Soares, 2014; Sniehotta, Scholz, & Schwarzer, 2005) was also present in our study, and
611 cultural differences in terms of planning and action control might be a possible factor (Hagger
612 & Luszczynska, 2014). However, the variation in the intention-behaviour relations could be
613 due to external factors such as academic term, exams, coursework that might have potentially
614 inflated the error variance in our prospective measure of behaviour. Future studies should

615 carefully control the discrepancies of these confounding factors on learning behaviours
616 between national groups.

617 **Practical Recommendations**

618 From a practical perspective, the pattern of results in the current study implies that the
619 teaching style of lecturers is pivotal to students' after-lecture learning behaviour and academic
620 outcomes. So it might be valuable for University lecturers to consider ways to support
621 students' autonomous motivation during lecture time. Means to promote autonomous
622 motivation from the TCM and SDT are to support students' psychological needs for
623 autonomy, competence, and relatedness within the social environment i.e. during lecture time.
624 Examples of an autonomy- or need-supportive environment include respecting students'
625 views and opinions, providing a meaningful rationale for studying, allowing time for students
626 to work independently, offering encouragement and hints, and encouraging student-to-student
627 or student-to-lecturer interactions (Reeve & Jang, 2006). There are now comprehensive
628 training programmes that have been shown to be effective in promoting better autonomy
629 support by leaders and social agents (Chan et al., 2011; Chan, Lonsdale, Ho, Yung, & Chan,
630 2009; Cheon & Reeve, 2013; Cheon et al., 2012; McLachlan & Hagger, 2010b). These types
631 of programmes would be the first step in developing skills for the delivery of interventions
632 that will be effective in promoting better educational outcomes. We would also expect these
633 programmes to be universally effective and generalisable. This is consistent with social
634 cognitive theories and self-determination theory, which are conceptualised as generalised
635 theories of behaviour and, therefore, should not vary across cultural contexts (Hagger et al.,
636 2007; Hagger & Chatzisarantis, 2015). A corollary of this is that means to promote autonomy
637 support should also be effective across cultural contexts. We look to future research to
638 ascertain the cultural and cross-national consistency of interventions adopting autonomy
639 support interventions in a higher education context.

640 Limitation and Future Directions

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

649 Second, the three-wave prospective design somewhat reduced the issue of response
650 consistency tendency (Chan & Hagger, 2012d; Hagger et al., 2003), and, more importantly,
651 allowed a prospective prediction of future behaviour when controlling for past behaviour.
652 This design meant that we could explicitly model the unique effects of the psychological
653 constructs on behaviour change independent of habit and automatic processes that are likely
654 to be accounted for by the effects of past behaviour (Gardner, 2015; Hagger, Rebar, et al.,
655 2015; Rebar et al., 2015). However, future studies should adopt randomised controlled
656 designs that test whether the manipulation of the autonomy support of lecturers may lead to
657 changes in motivational, social cognitive, and behavioural outcomes proposed in the model
658 (Hagger & Chatzisarantis, 2009a, 2012). In addition, a longitudinal, cross-lagged panel design
659 in which perceived autonomy support and autonomous motivation in both in-lecture and out-
660 of-lecture contexts is measured would provide evidence as to whether there are reciprocal
661 effects across contexts. Such evidence would be consistent with Vallerand's (2000) notion of
662 interplay between forms of motivation in contexts and broaden and deepen the trans-
663 contextual model.

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

676 **Conclusions**

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

685 Although there were some idiosyncratic differences in individual effects across
686 samples, the overall picture was that the proposed pattern of effects in the TCM was
687 supported. However, concerns remain over the relative weakness of the intention-behaviour
688 relationship in two of the three samples, which opens to question whether interventions

689 targeting the key motivational and social cognitive will engender actual behaviour change

690 (Webb & Sheeran, 2006).

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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

Note. 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. R² is the variance explained in the mediation model.

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

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, $p < .01$

Note. 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
<u>UK Cross-Sectional Data (N = 245)</u>												
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
<u>Pakistan Data (N = 90)</u>												
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

Note. 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.

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 ¹
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)	

Note. 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.

¹Significance 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.

Table 5
The results of mediation analysis

Path ¹	Direct Effect	Combined Effect	Indirect Effect	Total Effect
<u>UK-Cross-sectional (Model 1)</u>				
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
<u>UK-Prospective (Model 2)</u>				
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
<u>China-Prospective (Model 3)</u>				
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
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*

Note. 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.

¹The mediators in the paths are not presented for clarity reasons. The paths are bolded when significant mediations are presented.

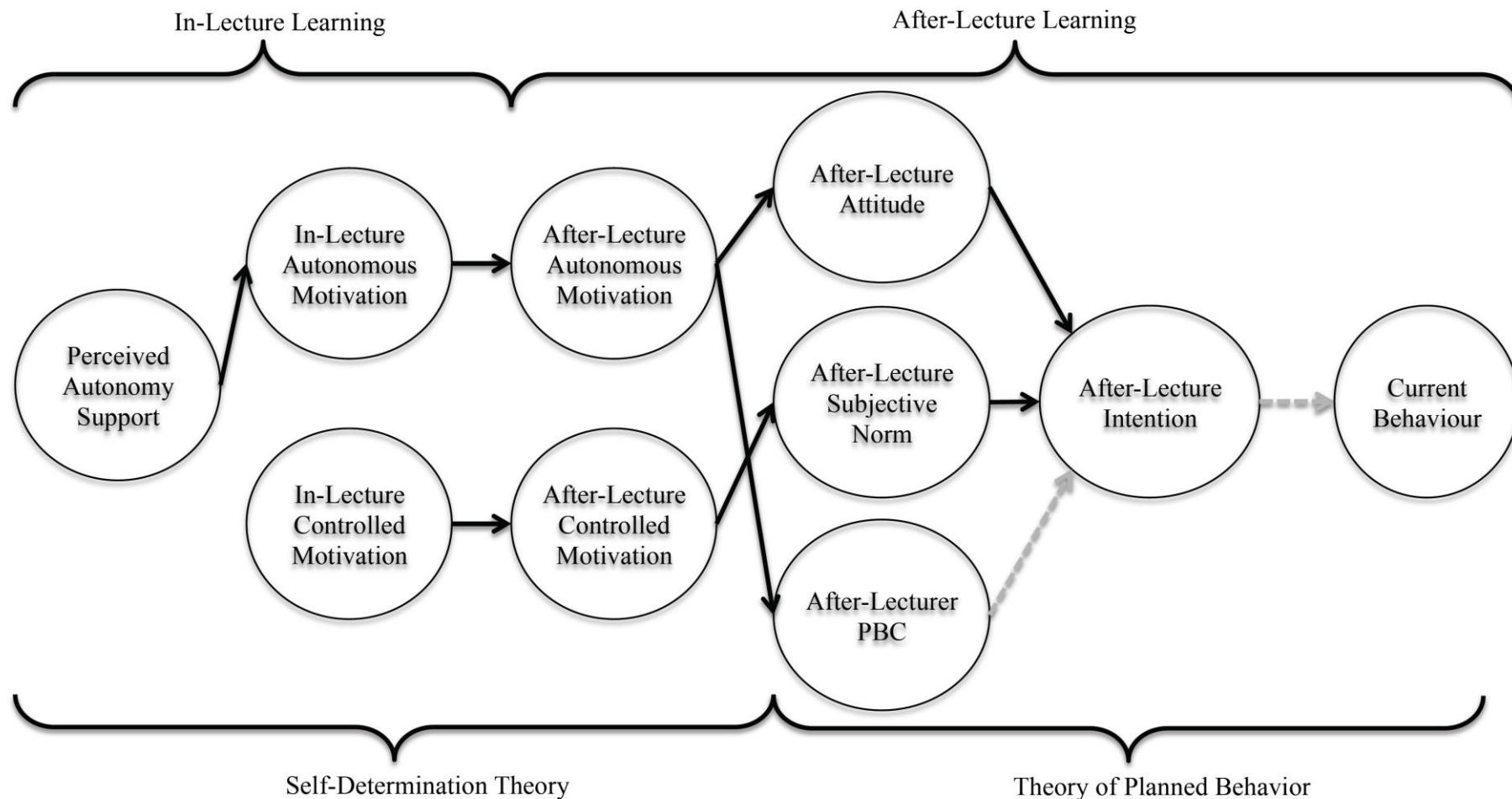


Figure 1. Results of the mediation model tested in each sample.

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.

Appendix A
Items of the Study

Scale/ Construct	Dimension	Items								
Learning Climate Questionnaire (Black & Deci, 2000)	Perceived Autonomy Support	<p>Anchors: 1 = strongly disagree, 7 = strongly agree</p> <ol style="list-style-type: none"> 1. I feel that my lecturer provides me choices and options. 2. I feel understood by my lecturer. 3. My lecturer has conveyed confidence in my ability to do well in the course. 4. My lecturer encouraged me to ask questions. 5. My lecturer understands how I would like to do things. 6. My lecturer tries to understand how I see things before suggesting a new way to do things. 								
		In-Lecture Learning Motivation, items adapted from the Academic Learning Self—Regulation Questionnaire (Black & Deci, 2000)	Autonomous motivation	<p>Anchors: 1 = strongly disagree, 7 = strongly agree</p> <ol style="list-style-type: none"> 1. I try to take notes and to listen attentively in the lectures because I enjoy learning. 2. I try to take notes and to listen attentively in lectures to learn more knowledge. 3. I try to take notes and to listen attentively in lectures because it's fun to learn. 4. I try to take notes and to listen attentively in lectures because I want to understand the subject more deeply. 5. I try to do well during the lecture because I enjoy doing my school work well. 6. I try to do well during the lecture because it's important to me to try to do well in school. 						
				After-Lecture Learning Motivation, items adapted from the Academic Learning Self—Regulation Questionnaire (Black & Deci, 2000)	Controlled motivation	<p>Anchors: 1 = strongly disagree, 7 = strongly agree</p> <ol style="list-style-type: none"> 1. I have to take notes and to listen attentively in lectures because I want the other students to think I'm smart. 2. I try to take notes and to listen attentively in lectures because I feel ashamed of myself when I don't try. 3. I try to take notes and to listen attentively in lectures because that's what I'm supposed to do. 4. I try to take notes and to listen attentively in lectures because I want the lecturer to approve of me. 5. I try to do well during the lecture because that's what I'm supposed to do. 6. I try to do well during the lecture so my lecturer will think I'm a good student. 7. I try to do well during the lecture because I will get in trouble if I don't do well. 8. I try to do well during the lecture because I'll feel really bad about myself if I don't do well. 9. I try to do well during the lecture because I will feel really proud of myself if I do well. 10. I try to do well during the lecture because I might get a reward if I do well. 				
						After-Lecture Learning Motivation, items adapted from the Academic Learning Self—Regulation Questionnaire (Black & Deci, 2000)	Autonomous motivation	<p>Anchors: 1 = strongly disagree, 7 = strongly agree</p> <ol style="list-style-type: none"> 1. I revise and study the subject after lectures because it's fun. 2. I revise and study the subject after lectures because I want to understand the subject more deeply. 3. I revise and study the subject after lectures because I enjoy doing it. 4. I revise and study the subject after lectures it's important to me to do it. 5. I work on my coursework after lectures because I want to learn new things. 6. I work on my coursework after lectures because it's enjoyable. 7. I work on my coursework after lectures because I enjoy doing my coursework. 8. I work on my coursework after lectures because it's important to me to work on my coursework. 		
								After-Lecture Learning Motivation, items adapted from the Academic Learning Self—Regulation Questionnaire (Black & Deci, 2000)	Controlled motivation	<p>Anchors: 1 = strongly disagree, 7 = strongly agree</p> <ol style="list-style-type: none"> 1. I revise and study the subject after lectures because I want the teacher to think I'm a good student. 2. I revise and study the subject after lectures because I'll get in trouble if I don't. 3. I revise and study the subject after lectures because I will feel bad about myself if I don't. 4. I revise and study the subject after lectures because that's what I'm supposed to do. 5. I work on my coursework after lectures so that the lecturer won't disapprove of me. 6. I work on my coursework after lectures because I want the lecturer to think I'm a good student. 7. I work on my coursework after lectures because I'll be ashamed of myself if it didn't get done. 8. I work on my coursework after lectures because that's the rule.
										Theory of Planned Behaviour Variables (Ajzen, 2002a)

Subjective Norm	Anchors: 1 = strongly disagree, 7 = strongly agree	<ol style="list-style-type: none"> 1. Most people who are important to me think that I should revise and study the subject after lectures in the forthcoming 5 weeks 2. It is expected of me that I revise and study the subject after lectures in the forthcoming 5 weeks 3. The people in my life whose opinions I value would approve me revising and studying the subject after lectures in the forthcoming 5 weeks
Perceived Behavioural Control	Anchors: 1 = strongly disagree, 7 = strongly agree	<ol style="list-style-type: none"> 1. It is possible for me to revise and study the subject after lectures in the forthcoming 5 weeks 2. If I want to I could revise and study the subject after lectures in the forthcoming 5 weeks 3. I have complete control over how to revise and study the subject after lectures in the forthcoming 5 weeks 4. It is mostly up to me whether or not I revise and study the subject after lectures in the forthcoming 5 weeks 5. It is easy for me to revise and study the subject after lectures in the forthcoming 5 weeks
Intention	Anchors: 1 = strongly disagree, 7 = strongly agree	<ol style="list-style-type: none"> 1. I intend to revise and study the subject after lectures in the forthcoming 5 weeks 2. I will try to put great effort into revising and studying for the subject after lectures in the forthcoming 5 weeks 3. I plan to revise and study the subject after lectures in the forthcoming 5 weeks
Behavioural Adherence of After-Lecture Learning, adapted from Trautwein (2007).	Self-Reported Behavioural Adherence	<ol style="list-style-type: none"> 1. I've been doing my [subject] coursework to the best of my ability 2. I do my best on my [subject] coursework. 3. I always try to finish my [subject] coursework. 4. I think I spend more effort and care on my [subject] coursework than my classmates 5. I've been studying [subject] after lectures to the best of my ability. 6. I always try to improve my knowledge of [subject] after lectures. 7. I think I spend more effort and care on studying [subject] after lectures than my classmates.