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(Latent) transitions to learning at university: a latent profile transition analysis of first-year Japanese students

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Abstract During the past decade, quantitative researchers have examined the first-year university experience from both variable-centred and person-centred perspectives. These studies have, however, generally been cross-sectional and therefore often failed to address how student learning changes during this transition. Furthermore, research has been undertaken chiefly with Western students, creating a significant gap considering the fact that students from a Confucian cultural heritage are a significant portion of the international higher education population. The present study seeks to address these weaknesses in the existing literature by employing a longitudinal person-centred approach to understanding the latent subgroups within a first-year student population at one Japanese university. Survey and achievement data from students (n = 920) attending one private university in western Japan at the beginning and end of their first academic year were analysed. Latent profile transition analysis (LPTA) identified three latent groups at time 1 and at time 2. LPTA mover-stayer modelling highlighted a pattern of students moving towards less adaptive groups over time. In particular, the least adaptive group increased in size, and no students from the low group managed to transition to the highest group during the course of their first year at a university.

Keywords Learning strategies · Longitudinal · Latent transition analysis · Japanese university · Learning environment · Approaches to learning

Introduction

Japan has arguably the most established system of higher education in Asia. This well-organised system, along with its feeder elementary and secondary schools, has been in large

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part credited for Japan's epic recovery following World War 2. However, both international (e.g. Cummings 1994; Doyon 2001; Hayes 1997) and Japanese writers (e.g. Amano 1986, 2014; Kariya 2011, 2012) have criticised the quality of Japanese higher education and highlighted a range of concerns regarding its future. Despite the burgeoning literature flagging the quality of student learning within Japanese universities as a critical issue (e.g. two special issues in the current journal and OECD reviews of tertiary education), scant internationally published empirical research has engaged with it. The current study aimed to begin to address the empirical gap by entering into this discussion from the perspective of students. A person-centred, longitudinal research design was employed to uncover how students with a range of profiles make the transition from high school to university learning. Aiming to understand the role of this new environment within students' learning, a student learning theory perspective on the interaction between perceptions of the learning environment and students' approaches to learning was the focus of the current study.

Merits and criticisms of education in Japan

Despite declining from its peak, Japan has still consistently remained high in the international rankings (OECD 2001, 2004, 2007, 2012). Contrasting with the well-known strengths of Japanese primary and early middle school education, significant criticisms have been put forth regarding the nature and focus of the country's high school education (e.g. Yoneyama 1999).

Japanese higher education has faced even stronger criticisms than Japanese secondary education. These criticisms began to mount during the 1970s–1980s and have been paralleled by attempts at national reforms to the country's system of higher education (for an account of these reforms and their outcomes, see Itoh 2002; Reiko 2001; Yoshida 2002). The chief criticisms of Japanese higher education have been levelled at (1) the intense system of entrance exams and their negative washback on secondary education (Doyon 2001; Frost 1991; Takeuchi 1997), (2) the generally low expectations of universities relative to secondary school (Teichler 1997; Yonezawa 2002) and the related very high graduate rates (e.g. OECD 2008 2014) and (3) finally its crucial role as a sorting and preparation (Nguyen et al. 2005; Takeuchi 1997; Yano 1997) device for entry into the workplace.

Japan's system of education is effective at creating a population with strong numeracy and reading skills. At the end of this education, academic Japanese high schools are rigorous and focus a considerable portion of their final 2 years on preparing students for entrance exams to university. In addition to their demanding secondary school life, many students engage in afterschool test preparation classes for these university entrance exams (>70%; OECD 2012). The transition from this intense preparation and strong primary and middle school experiences, to what has been referred to as a moratorium on learning during university (Doyon 2001), is a gap in our understanding of the Japanese education experience. How do students' perceive these new university environments, and how do they engage with their courses? How do their study strategies adapt?

Student learning theory

The transition to the teaching and expectations of university, and the kind of learning students undertake in response to these conditions, is perhaps best understood within student learning theory. Based on student learning theory (Marton and Säljö 1984), deep approaches to learning describe a paired intention to understand with processing that seeks connections and works to

understand the meaning of text. In contrast, surface approaches describe a paired intention to meet the immediate demands of assessment with processing orientated towards identifying and remembering the essential facts.

Parallel to considerable subsequent quantitative research examining the students' learning strategies at a university (e.g. Biggs 1987; Biggs et al. 2001; Tait and Entwistle 1995; Tait et al. 1998), qualitative and then quantitative (Entwistle and Ramsden 1983; Ramsden and Entwistle 1981) research was also being undertaken to measure students' perceptions of university learning environments (Course Experience Questionnaire; Elphinstone 1989; Ramsden 1991). These two research areas have been employed together across a broad array of studies seeking to explain and improve student learning during university (e.g. Fryer et al. 2014; Diseth 2007; Richardson 2010). Furthermore, both theory and consistent evidence has suggested that the learning environment and students' approaches are strongly linked (Richardson 2005). Cross-sectional (Richardson 2010) and longitudinal (Fryer and Ginns, under review) research have supported the reciprocal modelling of perceptions of the learning environment. In particular, students' perceptions of the quality of the teaching they received and students' deep approaches have an established especially strong relationship (e.g. Wilson et al. 1997; Lizzio et al. 2002). This history of theory and empirical evidence suggests that these tightly intertwined components of formal learning might best be understood together.

In Japan, exploratory research examined (Fryer et al. 2012) and effectively modelled (Fryer and Ginns, under review; Fryer et al. 2014) students' approaches to learning and key aspects of the learning environment. This research has suggested that while there are culturally specific relationships, the broadly held model of student learning theory holds and is relevant to the Japanese university teaching and learning experience. That is, there is a complex reciprocal relationship between the learning environment and how students approach their learning. This body of research, like much of student learning research, has employed a variable-centred perspective. A variable-centred research design can be an effective means of explicating the relationships between latent variables, but research designs of this type generally fail to engage with anything but the average student's experience (for discussion of related issues, see Lindblom-Ylänne et al. 2015). Qualitative research can be a powerful tool for small-scale research into the student experience (e.g. Postareff et al. 2015; Prosser and Trigwell 2014); however, to understand the students at a larger scale (i.e. subgroups), a person-centred design bridges the gap between the two approaches to understanding the student experience.

Student approaches to learning and Asian learners

Considerable student approaches to learning research has been undertaken with Asian learners. While the majority of this research has focused on students in Hong Kong institutions (e.g. Kember 2000), work with students in Mainland China (e.g. Marton and Wong 2005), Nepal (Watkins and Regmi 1992) and Japan (e.g. Fryer et al. 2012) have built towards an increasingly comprehensive portrait. At the heart of this subfield stands what is referred to as the paradox of the Chinese learner (Watkins and Biggs 1996, 2001). The paradox that was addressed (in) directly by this body of research was the observation that the Chinese learner was perceived to be using low-level rote strategies and yet often achieved at a high level. In a recent chapter, Bernardo and King (2016) both point to the substantial work already done and call for more research looking into the "relationships and interactions between psychology constructs and processes" (p. 663). The current study seeks to address this call by presenting a novel longitudinal perspective on well-known components of this field.

The development of students' approaches to learning

Very few longitudinal studies have worked to understand how students' approaches to learning develop during the university experience. The longitudinal research, which has been undertaken (e.g. Watkins and Hattie 1985; Zeegers 2001; Coertjens et al. 2013), has suggested that tertiary education has a broadly adaptive effect on the quality of students' approaches to learning. Furthermore, longitudinal research (from the Japanese context; Fryer and Ginns, under review; Fryer et al. 2014) and reviews of the literature (Baeten et al. 2010) have demonstrated that teachers can play a substantial role within the development of students' approaches to learning during higher education. The vast majority of the studies that have addressed this question, however, have done so from a variable-centred perspective. While this type of research design can inform us about the longitudinal relationship between theoretical variables, these results fail to address the heterogeneity within samples and therefore do not engage with how distinctly different students' develop over time. Latent curve modelling, for example, is an analytical perspective that addresses the development of specific individual differences (for a recent example, see King 2015) but fails to address the broader multivariate picture. The range of clustering techniques available that address this gap generally fails to address developmental questions. To ask developmental questions, while engaging with multiple aspects of the student experience and accounting for the natural heterogeneity in a sample, a person-centred longitudinal analytical framework is necessary.

Person-centred analysis

Person-centred research within the student learning framework has been employed to successfully describe theoretically consistent groups of learners. Prosser and colleagues have consistently observed a pair of clearly adaptive (deep) and maladaptive (surface) groups across studies in different contexts (Crawford et al. 1998; Prosser et al. 2003a, b).

Also, researching approaches to learning, but including a wider variety of covariates, Heikkilä and colleagues (Heikkilä et al. 2012; Heikkilä et al. 2010) identified three groups of students. These clusters generally emerged as an adaptive self-directed group and two less adaptive clusters.

Cross-sectional person-centred research, while a helpful descriptive tool, does scant to explain how students change when engaging with new learning environments as they must when adapting to learning at university during their first year. A flexible analytical tool for both cross-sectional and longitudinal person-centred research is therefore necessary. We would suggest that latent profile (transition) analysis fits this need.

Modelling transitions across first year at a Japanese university

The current study builds on recent variable-centred research employing the student learning theory framework in the context of Japan. Consistent with past studies in this research context (i.e. Fryer and Ginns, under review; Fryer et al. 2016; Fryer et al. 2014; Fryer 2013; Fryer et al. 2012), the current study utilised a measure of deep and surface approaches (Trigwell and Ashwin 2006) to represent student learning. To represent students' experiences of the learning environment, we relied on the two most reliable and valid (based on past confirmatory factor analyses) scales from Course Experience Questionnaire (Elphinstone 1989; Ramsden 1991):

good teaching and generic skills. The two scales also represent logical "input" (good teaching) and "output" (generic skills) aspects of the learning environment.

A longitudinal person-centred approach was employed to begin to explain the student experience across the critical first year at a Japanese university. First year at university is a critical transition that involves both learning and social adjustments (Briggs et al. 2012; Pascarella et al. 2004). This freshman year sets the stage for the final formal learning experience most students will engage in, an educational experience that will have significant, lifelong repercussions (Pascarella and Terenzini 2005). As a result, understanding how this first-year engagement is related to students' strategy and learning environment perceptions is worth addressing.

Aims and hypotheses

The current study sets out to examine the person-centred development of students as learners across their first year at a Japanese university. This was undertaken by first examining the sample for latent subgroups at the beginning and end of the academic year. Student movement between these subgroups was then tracked. This study therefore set out to test five hypotheses. First, inter-relationships between perceptions of the learning environment and students' approaches to learning, consistent with past findings in the context of Japan (Fryer et al. 2012), were expected (hypothesis 1). Specifically, we expected a moderate positive relationship between deep and surface approaches to learning and a strong positive relationship between deep approaches to learning and perceptions of good teaching. Second, consistent with past cluster analyses of student learning theory variables (e.g. Prosser et al. 2003a, b), at least two latent subgroups were expected to emerge from both time 1 and time 2 samples. We expected one primarily deep and one primarily surface approach group (hypothesis 2). Consistent with recent latent growth analysis-centred research examining the development of students' approaches to learning (i.e. Coertjens et al. 2013), we expected a decrease in students' reliance on surface approaches to learning (hypothesis 3). More specific to the analytical framework utilised in the current study, each of the latent subgroups found was expected to improve in the quality of their approaches pursued: i.e. all groups were expected to pursue more deep and less surface approaches (hypothesis 4). Finally, consistent with the hypothesised pattern of improvement, we also expected an overall trend of students moving to the more adaptive (higher deep and lower surface approaches) subgroups over the course of the academic year (hypothesis 5).

Methods

Participants

First-year students (total, n = 920; female, n = 274), studying within seven faculties (Management, Economics, Commerce, International Studies, Information Sciences, Engineering and Fine Arts) at one private university in western Japan participated in the current study. Students completed surveys after 1 month of classes at the beginning of the academic year and during the final month of the academic year. The surveys were a part of a large longitudinal, cohort study examining the Japanese university learning experience. Surveys were prefaced with an explanation of the study. This explanation stated that participation was voluntary and

that the self-reported information was not in anyway connected to their grade. Students were instructed to answer the survey based on their learning within their departmental classes. Surveys were undertaken during regular class time and took approximately 20 min to complete. Surveys were completed 4 weeks into students' first semester at a university and again 2 weeks prior to the end of classes.

Instruments

Based on prior pilot research (Fryer 2013; Fryer et al. 2012) and a longitudinal study (Fryer et al. 2014), surface and deep approaches as measured by the Approaches to Study Questionnaire (adapted by Trigwell and Ashwin 2006) were employed to measure students' learning strategies. In addition to students' strategies, their perceptions of good teaching and accumulated generic skills (from the Course Experience Questionnaire; Elphinstone 1989; Ramsden 1991) were also assessed at the beginning and end of students' first year at university. All surveys employed a six-point Likert scale. Perceptions of the learning environment were measured across a strongly disagree (1) to strongly agree (6) scale. Both good teaching and generic skills scales consisted of five items each. Students' strategies were measured across a totally unlike me (1) to totally like me (6) scale. Both surface and deep approaches scales consisted of five items. The highest loading item for each scale is presented in Table 1.

Data management and analyses

Missing data (<3%) were imputed employing EM algorithm (LISREL 8.80; Jöreskog and Sörbom 2006) prior to undertaking any analyses. All latent analyses in the current study were undertaken with M*plus* 7.0 (Muthén and Muthén 1998–2013) utilising the maximum likelihood robust estimator. This estimator provides standard errors which are robust to violations of the assumption of normality that often arise when using ordinal measures, such as those used in the current study. For descriptive statistics and difference testing with observed variables, JMP (SAS 2007–2011) was employed.

Fit for structural equation modelling in the current study was based on one incremental (comparative fit index (CFI)) and one absolute (root mean square error of approximation (RMSEA)) measure of fit. Acceptable/good fit was RSMEA values below 0.05/0.08 (Browne and Cudeck 1992) and CFI values above 0.90/0.95 (McDonald and Marsh 1990).

Latent profile analysis (LPA) is a term generally used to describe latent variable mixture analysis (Magidson and Vermunt 2004) with continuous cluster indicators. Latent profile transition analysis (LPTA) is an extension to LPA, which integrates auto-regressive (a variable

Table 1 Highest loading item from each scale

Scales	Highest loading item
Deep approaches to learning	Ideas in course books or articles often set me off on long chains of thought of my own
Surface approaches to learning	I often have trouble in making sense of the things I have to remember
Good teaching	Staff here put a lot of time into commenting on students' work
Generic skills	This course has sharpened my analytic skills

predicting itself in the future) modelling (Nylund et al. 2006) to examine group membership over time. In contrast to standard K-mean approaches to longitudinal person-centred analysis (for a recent example, see Entwistle and McCune 2013), LPTA can simultaneously estimate group membership at multiple time points and the transition between these subgroups between time points. LPTA can thereby estimate where students start (their initial subgroup profile) upon entering university and then provide the same information at the end of the year. Finally, LPTA maps how students move between these groups, providing probability estimates of both group memberships and transitions, thereby precisely describing students' transition to the university learning experience.

For all profiling undertaken in the current study, mean scores based on the validated scales presented were utilised. For the latent profile and latent transition profile analyses, fit was assessed by employing five fit indexes: two likelihood ratio tests and three information criterion indexes: The Vuong-Lo-Mendell-Rubin likelihood ratio test (Vuong 1989) and Lo-Mendell-Rubin likelihood ratio test (Lo et al. 2001) both provide a test of whether there is a statistically significant improvement for an addition of one more class to the model (Nylund 2007). Akaike's information criterion (AIC; Akaike 1987), the Bayesian information criterion (BIC; Schwartz 1978) and the sample size-adjusted BIC model are each selection criterion, wherein lower values indicate the preferred model. As a post hoc evaluation of group separation, an entropy criterion was employed. Entropy criterion is a summary statistic of all posterior probabilities derived by the model (Celeux and Soromenho 1996). Entropy is incremental, with numbers closer to 1 representing better classification of a sample into subgroups. While all four information criteria have their weaknesses, the BIC is generally seen as being the most useful information criterion guide for LCAs (Nylund-Gibson et al. 2014).

In addition to these indices and fit criterion, decisions regarding the optimal number of classes were also guided by the relative size of the classes and their theoretical meaningfulness. Following latent profile analyses, ANOVAs were conducted to assess the variance explained by the finalised profiles for each variable.

Results

Convergent/divergent validity and descriptive statistics

A confirmatory factor analysis (CFA) of good teaching, generic skills, deep approaches and surface approaches together was undertaken at each time 1 and time 2. This analysis was done to test the convergent and divergent validity of the variables under the study. CFAs resulted in acceptable fit: time 1 CFI = 0.91, RMSEA = 0.053 (90% CI = 0.048–0.058); time 2 CFI = 0.92, RMSEA = 0.058 (90% CI = 0.053–0.063). These results and the correlations (Table 2), which are consistent with past studies in the research context and longstanding theory, suggested sufficient construct validity for the proposed longitudinal analyses.

The latent correlations for both time 1 and time 2 variables are presented with the mean and standard deviation for all variables at time 1 and time 2 (Table 2). Gender (dummy coded female = 1, male = 2) was not significantly related to any of the variables. The relationships both within time 1 and time 2, as well as the relationships across times 1 and 2, were consistent with past findings within the field of student learning theory. The one relationship somewhat unusual internationally, but found previously in Japan (Fryer et al. 2014; Fryer et al. 2012), is

Table 2 Correlations and descriptive statistics

		1	2	3	4	5	6	7	8	9
1	FM									
2	Good teaching T1	−0.04								
3	Generic skills T1	−0.06	0.67**							
4	Surface approaches to learning T1	0.01	0.06	0.07						
5	Deep approaches to learning T1	−0.06	0.29**	0.42**	0.26**					
6	Good teaching T2	−0.06	0.39**	0.22**	0.02	0.18**				
7	Generic skills T2	−0.03	0.38**	0.41**	−0.01	0.26**	0.66**			
8	Surface approaches T2	0.03	0.07*	0.03	0.43**	0.09**	0.10**	0.09**		
9	Deep approaches T2	−0.06	0.25**	0.28**	0.07*	0.46**	0.32**	0.49**	0.24**	
	Mean		4.11	4.01	3.93	3.58	3.83	3.74	3.84	3.50
	SD		0.65	0.65	0.63	0.65	0.79	0.72	0.67	0.71

FM gender (female = 1, male = 2)

*$p < 0.05$, **$p < 0.01$

the moderate positive relationship between surface and deep approaches to learning (time 1 $r = 0.26$, $p < 0.01$; time 2 $r = 0.24$, $p < 0.01$).

Across the two time points, a significant ($p < 0.01$; Bonferroni adjustment employed) pattern of decline is present across all four variables: surface approaches ($t = -4.14$, $d = 0.13$), deep approaches ($t = -3.57$, $d = 0.12$), good teaching ($t = -10.32$, $d = 0.37$) and generic skills ($t = -11.09$, $d = 0.39$). These differences were small for the strategies and moderate for students' perceptions of the learning environment. Independent t tests of male and female students' strategies and perceptions of the learning environments at times 1 and 2 revealed no significant differences ($p < 0.05$; Bonferroni adjustment employed).

Latent (transition) profile analyses

As noted, both samples were tested for two, three, four and five latent group profiles. The fit for the latent profile analyses of the time 1 and time 2 samples is presented in Table 3. BIC clearly supported a three-group solution for both samples. As is common (see Nylund-Gibson et al. 2014), BIC never reached a lowest point and the elbow (i.e. the last relatively large decrease in the BIC value) was used as a guide. In support of this guide, Vuong-Lo-Mendell-Rubin test approached non-significance ($p > 0.05$) and entropy levelled out at a relatively high amount suggesting good separation for the groups. For both waves, two moderate-sized groups (high and low) and one large group (mid) were present. The low group represented students who reported particularly low experiences of both good teaching and generic skills at both times 1 and 2. These students also reported very low use of deep approaches, instead increasingly preferring surface approaches to learning over time. The mid group reported very average experiences, with an increasing preference for deep approaches between times 1 and 2. Finally, the high group reported the strongest experience of all measured variables and an increasing preference for deep over surface approaches to learning over time. Based on these cross-sectional results, we proceeded with latent transition analyses of the longitudinal data.

Table 3 Fit for time 1 and time 2 latent profile analyses

Fit criterion	Time 1					Time 2				
	1	2	3	4	5	1	2	3	4	5
Akaike information criterion (AIC)	7241.46	6853.80	6627.04	6570.99	6520.038	7975.59	7628.69	7346.66	7256.00	7218.51
Bayesian information criterion (BIC)	7280.05	6916.51	6713.88	6681.95	6655.12	8014.17	7691.38	7433.46	7366.91	7353.53
Sample-sized adjusted (BIC)	7254.65	6875.23	6656.71	6608.90	6566.19	7988.76	7650.09	7376.30	7293.87	7264.60
Entropy		0.68	0.80	0.80	0.82		0.58	0.79	0.75	0.78
Vuong-Lo-Mendell-Rubin	<0.001	<0.001	<0.001	0.49	0.32	<0.001	0.50	<0.001	0.41	0.46
Lo-Mendell-Rubin	<0.001	<0.001	<0.001	0.50	0.33	<0.001	0.51	<0.001	0.45	0.47
Parametric bootstrapped likelihood ratio	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Again, similar to the cross-sectional analysis, two, three, four and five groups were extracted in order to evaluate the best fitting model. The fit results are presented in Table 4. BIC again, based on the last relatively large drop in BIC value, supported the three-group model. While BIC did reach its lowest value at four subgroups, which might suggest four rather than three groups, both sample size-adjusted BIC and AIC continued to drop. Furthermore, one of the groups in the four-group model was very small (1.5%). The log-likelihood and entropy tests were unavailable for LPTA fit outputs.

To assess the relative difference of the modelled variables across the three groups for each sample, ANOVAs were conducted. All ANOVAs resulted in significant differences (Table 5). All variables were found to be significantly different across the three finalised groups. With the exception of surface approaches, the differences between the variables across the three latent groups explained a substantial amount of variance (Table 5).

The finalised time 1 and time 2 profiles are standardised and presented in Fig. 1. Figure 1 presents a pattern of profile improvement for the mid and high group but not the low group. Across time 1 and time 2, increasingly adaptive perceptions of the learning environment are present for all three groups. A small increase in surface approaches was present for the low group, while the mid and high groups both presented small increases in deep approaches.

Transition outcomes and profiles

The pattern of transition between groups is presented in Fig. 2. There is an overall pattern of students moving from higher to lower latent groups over the academic year. Eighty-two students moved from the high to mid group, and 35 students moved from the mid to the high group. From the high group, seven students moved to the low group. From the mid group, 78 students moved to the low group while 19 students moved from the low to the mid group. No students moved from the low group to the high group.

Table 6 presents the samples for the mover-stayers. In the context of the current analysis, "movers" refer to individuals who change groups across time 1 to time 2, while "stayers" refer to individuals who remain in their time 1 group across the study.

Figure 3 presents the profiles for the mover-stayer groups. A substantial number of low 1 students stayed low 2 (80%). There were only two mover-stayer groups for students beginning in low 1. On the other hand, low 1–low 2 (n = 112) stayers remained low in all profiled variables across the research gap. The profile of the small low group (low 1–mid 1; n = 19) to make the transition to the mid group had no clearly distinguishing features to signal why they made this move. Students beginning in the low group failed universally to join the high group.

The mid group had the highest proportion of stayers (84.6%). Students who began in the mid group had broadly consistent time 1 levels of all variables: very close to the mean. The mid 1–low 1 group (n = 78) had the lowest deep approaches but very consistent levels of surface approaches as the mid 1–high 2 group (n = 35) movers. The mid 1–mid 2 group

Table 4 Fit for two through five groups for the longitudinal latent profile transition

Fit criterion	Two subgroups	Three subgroups	Four subgroups	Five subgroups
Akaike information criterion (AIC)	14,300.24	13,800.40	13,641.49	13,542.17
Bayesian information criterion (BIC)	14,430.50	14,003.02	13,906.83	13,966.72
Sample size adjusted (BIC)	14,344.75	13,869.63	13,732.16	13,687.24

Table 5 ANOVAs for time 1 and time 2 subgroups

Time 1	Low	Mid	High	*p*	*F*	R^2
Good teaching time 1	−1.38a	−0.02b	1.29c	<0.01	542.41	0.54
Generic skills time 1	−1.39a	−0.06b	1.47c	<0.01	779.61	0.63
Surface approaches time 1	−0.04a	−0.06a	0.29b	<0.01	7.48	0.02
Deep approaches time 1	−0.78a	−0.05b	0.91c	<0.01	132.09	0.22
Time 2	Low	Mid	High			
Good teaching time 2	−1.04a	0.08b	1.61c	<0.01	469.45	0.51
Generic skills time 2	−1.24a	0.13b	1.64c	<0.01	744.95	0.62
Surface approaches time 2	−0.08a	0.00a	0.55b	<0.01	17.06	0.04
Deep approaches time 2	−0.77a	0.07b	1.17c	<0.01	170.01	0.27
N time 1/time 2 (percentage of sample)	131/197 (14/21)	639/617 (69/67)	150/93 (16/10)			

Within row means with different letters are significantly different from each other

(n = 526), right at the centre of the distribution, experienced very little change in profile across the year. The mid 1–high 2 group presented the highest time 1 deep approaches to learning of all three mid groups.

The high group had the lowest amount of stayers (39%). High 1–low 2 (n = 7) had the highest good teaching and surface approaches but the lowest deep approaches. The time 1 profile for high 1–mid 2 (n = 82) contrasted strongly with high 1–low 2. The balance of students' approaches was reversed, with students' predominantly pursuing deep approaches rather than surface approaches at time 1. At time 1, high 1–high 2 (n = 61) completes the

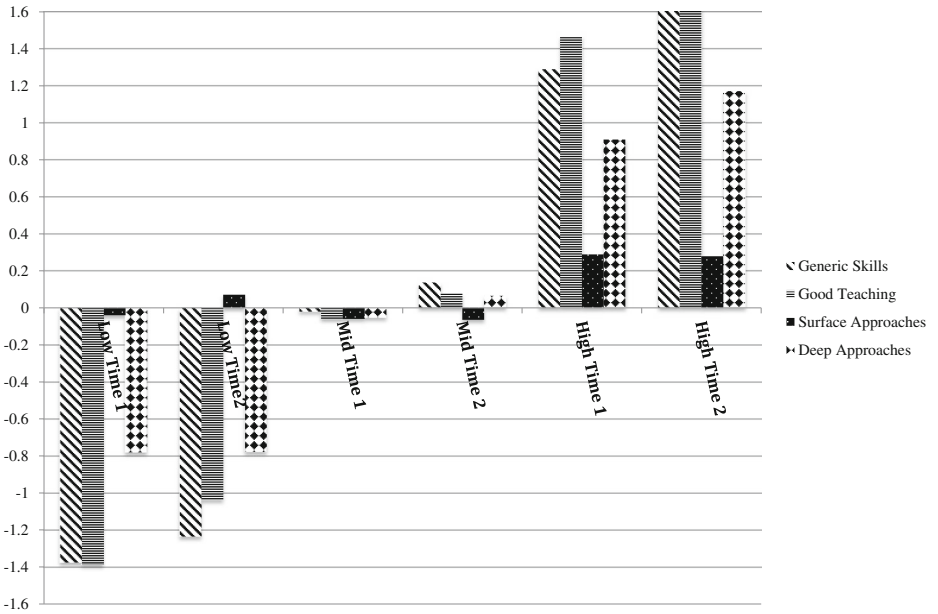

Fig. 1 Time 1 and time 2 profiles grouped into low, mid and high

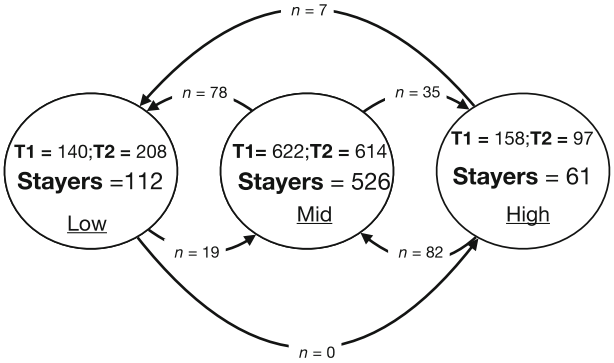

Fig. 2 Stayers and mover model

pattern presented across both the mid and high groups: increasing deep approaches at time 1 being linked to a high or increasingly adaptive group membership at time 2.

Discussion

The current study aimed to estimate the number of latent groups within a sample at two points, separated by 8 months: the beginning and end of the students' first academic year at a Japanese university. Initially, confirmatory factor analyses were conducted to assess the convergent/divergent validity of the variables modelled (surface approaches to learning, deep approaches to learning, perceptions of teaching quality and generic skills gained from the university experience). Correlational results both within and across the time points suggested relationships consistent with past student learning theory findings (hypothesis 1). Latent profile analyses were employed to estimate the latent groups based on students' self-reported results. Cross-sectional modelling indicated that three latent groups fit the data best at both time points (hypothesis 2). Mixed results regarding the quality of the three profiles were observed. Across the span of the study, surface approach either remained relatively consistent (mid) or increased (low and high). These results suggest that at least in the current context, the university experience does not seem to play a role decreasing students' reliance on surface approaches (hypothesis 3).

Table 6 Characteristics of participants that transition between data time points

	Low 2	Mid 2	High 2
Low 1	12.85% (male)	2.6% (male)	*n* = 0
	10.58% (female)	0.73% (female)	
	n = 112	*n* = 19	
Mid 1	8.98% (male)	56.35% (male)	3.87% (male)
	7.30% (female)	59.12% (female)	3.65% (female)
	n = 78	*n* = 526	*n* = 35
High 1	0.93% (male)	8.05% (male)	6.35% (male)
	0.36% (female)	10.95% (female) n	7.30% (female) n
	n = 7	*n* = 82	*n* = 61

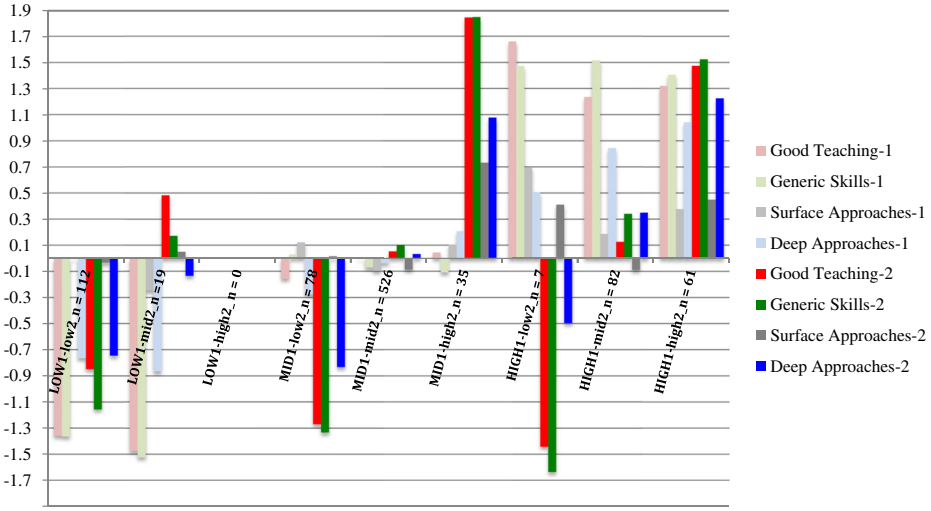

Fig. 3 Movers and stayer self-reported perceptions of teaching, generic skills and approaches to learning. *Low*, *Mid* and *High* refer to three subgroups at times 1 and 2. *1* and *2* refer to the data point time

While a clear pattern of perceptions of the teaching quality and generic skills was not clear, taking both strategies into consideration strategy development across the three groups appeared consistent both in time 1 to time 2 and with the groups' specific labelling. The low group students increasingly reported employing surface strategies but remained virtually unchanged with regards to deep approaches. In contrast, the reverse was observed in the mid and high group (hypothesis 4). Relative to surface approaches, deep approaches increased (time 1 to time 2) for the mid and high groups (hypothesis 4). Contrary to our final hypothesis, the latent transition results demonstrated that there was an overall pattern of students moving towards less adaptive profiles over the course of their first year at university (hypothesis 5).

Theoretical implications

Previous longitudinal research (e.g. Watkins and Hattie 1985; Zeegers 2001) has suggested that over time, students' approaches to learning improve: increasing deep approaches. The current study's findings suggest that the question is, as we would expect, more complicated than simple mean level changes. This study provided three somewhat contradictory perspectives on students' changing approaches to learning. First, on average, very little change was found for students' strategies across the year-long study. However, if the eight mover-stayer groups are examined at time 1 and again at time 2, overall most profiles improved: i.e. the floor seems to rise, as we would expect from a year at university. However, we also observed an overall downward movement of students from the mid and high groups overtime: i.e. some students step down a level as the floor rises.

Based on consistent research within the student learning theory framework from both cross-sectional (e.g. Wilson et al. 1997; Lizzio et al. 2002; Richardson 2010) and longitudinal perspectives (e.g. Fryer and Ginns, under review; Fryer et al. 2014), we expected high perceptions of good teaching in a time 1 group to signal a transition to an increasingly adaptive subgroup. The current study suggests, however, that this might not be the case. In fact, higher deep approaches at time 1 appeared to be the clearest signal of a transition to a more adaptive

group, for the mid and high groups. These person-centred longitudinal findings run contrary to early research and theory (e.g. Ramsden and Entwistle 1981; Ramsden 1979), extensive cross-sectional research (e.g. Lizzio et al. 2002; Richardson 2005, 2010; Wilson et al. 1997) and also variable-centred modelling in the specific context of Japan (Fryer and Ginns, under review; Fryer et al. 2014) which have suggested that teaching quality would be a key signal of the development of adaptive approaches to learning. This study's results present a more complex picture, both with regards to students' strategy development and its relationship with the learning environment. These results suggest that those students already pursuing a deep approach are more likely to continue to do so. These results are broadly consistent with recent person-centred results presenting a subgroup of students with a "disposition to understand" (Entwistle and McCune 2013). The current findings add a more incremental element to this conception, suggesting that a deep orientation in addition to attributing persistence in this approach might also encourage increased future deep learning.

Across the three examined groups, the variance of the four variables profiled was substantially different. The variance of students' perceptions of the environment was consistent and large; deep approaches were consistent and moderate, and finally, surface approaches were inconsistent and small. These findings suggest that students all use surface strategies to a similar degree—particularly the low and mid group students. These same students, however, perceived the environment they were learning very differently. The degree to which these groups employed deep approaches was also correspondingly different. The relative low variance in surface approaches could be related to the fact that the assessment and workload aspects of the learning environment—the classical correlates of surface approaches (see Wilson et al. 1997)—were not included in profiling. The alternative explanation is that students necessarily pursue surface approaches and that the range is small because the students perceive the departmental expectations of their environment similarly.

Deep approaches, in contrast to surface approaches, have established connections with individual differences such as efficacy (Trigwell et al. 2012) and personal goals (Fryer et al. 2016; Fryer et al. 2014). Longitudinal modelling has, therefore, suggested that students' confidence in their abilities and their personal goals are two important determinants of the depth of their approach to learning.

Past research in the context of Japan (Fryer et al. 2014; Fryer et al. 2012) indicated paired strategy use consistent with the "paradox of the Chinese learner" (Watkins and Biggs 1996, 2001). The current study's longitudinal profiling, however, signals towards differentiation and increasing divergence in strategy preference within emerging subgroup profiles across an academic year. These results suggest that a person-centred, longitudinal perspective might provide some contrast to standard correlational studies that have dominated the field to this point.

Practical implications

Perhaps the implication of the current study that raises the most concern is the finding that students who begin in the low group are likely to stay there. This lack of upward mobility, for students who need it most of all, is of considerable concern. None of these students make the jump to the high profile group over the course of the year, and overall, there is a net gain in low students. While this group's profile did see a small improvement in their overall deep approaches (time 1 to time 2), both movers and stayers from the low group ended up with deep strategies well below the sample mean. This, compared to clear development in the

majority of the mid and high group, sets up a desperate pattern in which some students remain depending on strategies to "get by" and the stronger students become more and more knowledgeable.

While the mean for the entire sample is a poor model, and we have seen that it does not accurately depict the experience of many students, it cannot be entirely ignored either. The means of all three variables decline over the course of the students' first year at a university, suggesting that the experience might not be benefitting students, at least with respect to the variables measured. This very general result, compounded by the mover-stayer analysis, which suggested that there is a net movement of students to less adaptive groups, together calls for an evaluation of the student experience. There is a gap in the transition to Japanese higher education that is perhaps wider than in the West. The demanding nature of Japanese high schools and the strong competition for position in select university faculties create a demanding learning environment. The students then transition to higher education, which is often a far less demanding experience. This gap in expectations along with the curriculum crowding common to Japanese higher education could be a significant source of the maladaptive patterns observed in the current study.

For educators interested in how we might support student transitions to more adaptive subgroups during their first year at a university, the results are neither straightforward nor hopeful. Examination of the transition profiles for each of the mover-stayer groups suggests that the most consistent signal of time 2 adaptive profiles are time 1 deep approaches. The exception to this pattern was the two low mover-stayer profiles, which do not provide any such indication of upward movement. This indicates that students from the least adaptive subgroups that neither enhanced strategies nor learning environments are clear signals of adaptive transitions.

Limitations and future directions

The key limitations for the current study are common to most studies in the field of student learning theory. While a longitudinal design and the strongest possible analytical approach were employed in the current study, the fact that the data itself were self-reported should not be forgotten when interpreting the results. The current study was undertaken at just one university, which limits its external validity for other institutions in Japan and abroad.

It is essential that the current study be replicated both in Japan at another institution and abroad in a range of cultural and academic situations. How students' strategies for learning change across the critical transition to university is an essential question, which might fuel university reform and thereby lead to greater support for high quality student learning. If future studies included important sources of individual differences such as efficacy and instrumental goals, this might reveal the types of time 1 profiles, which lead to more adaptive future group transitions.

Latent transition analysis can provide a powerful perspective on how students and student groups change over time. In the current study, two data points have been employed, but three or more are also possible. In future studies of membership change, predictors of class membership might also be modelled, thereby improving our understanding. As mentioned earlier, academic efficacy and instrumental goals for learning are two possible predictors that might be tested.

The low 1–mid 2 transition exhibited the least clear mover time 1 profile as it gave no clear indication at time 1 for why these students made the transition to a more adaptive profile at

time 2. There are at least two potential reasons for this lack of clarity. First is the "missing variable", i.e. we are not measuring the variable that might signal a transition. The second is whether the current sample was large enough to make interpretation of the mover-stayer groups meaningful. Future studies should work to address these issues by employing a larger sample in future analyses.

Past research has suggested that organised studying (time and effort management) seems to be an important factor predicting study success (Parpala et al. 2010). Future studies might therefore include a strategic/organised studying scale to expand on the current study's results both in Japan and internationally.

Conclusions

Modelling revealed a pattern of net student movement from adaptive to less adaptive profiles overtime. Findings at the mover-stayer profile level also suggested that a pattern of prior deep approaches was often the clearest signal of adaptive transitions by the end of students' first year. It might be very much the case that as so often happens in a market economy, so too in the university classrooms, "the rich simply get richer". The amount of deep strategies students have when they arrive at a university has longstanding implications for the quality of their learning across this crucial transition to a university.

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