Typology of Students: A View from Student Transition from High School to College

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ABSTRACT

Several recent studies have successfully identified several college student types. One limitation of past studies has been their reliance on one-time cross sectional assessments. As a result, we are left to ponder the stability or consistency of student behaviors as the academic year progresses. This study uses longitudinal data of student engagement to investigate the stability of student engagement typology. Guided by behavioral consistency theory, this study explores the supportive elements of educational settings in order to find those under which students' behavior-based types are more likely to change. Results showed that there are generally four student types based on their engagement in a variety of activities. In higher education settings, most students stick to a pattern of behaviors while a small portion changed compared with their engagement types in high school. Students' background characteristics and institutional environment showed association with these shifts.

Key words: college students, typology, engagement, transition

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Introduction

We often use taxonomic language in conversations about college students, such as female vs. male, minorities, international students, live off/on campus, and so on. Classifications from student background characteristics are convenient. They facilitate both research and administration. One way to group college students is based on their behaviors. A behavior-based student typology goes beyond grouping students by either demographic or enrollment characteristics. It utilizes observable measures about student behaviors from widely used student engagement surveys. The emergence of student engagement research reflects discontent with recent practices of learning outcome assessment (McCormick, Kinzie, & Gonyea, 2013). Often used as a process indicator of education quality (Ewell & Jones, 1993), student engagement has shown its close association with direct learning outcome measures (Carini, Kuh, & Klein, 2006).

A noted limitation of many previous studies of behavior-based college student typology, is the utilization of cross-sectional data to classify college students (e.g., Hu & McCormick, 2012; Kuh, Hu, & Vesper, 2000). Cross-sectional studies capture engagement at one moment in time, but fail to provide important information about the trajectory of behaviors across time and situations. There is scant evidence that supports a theoretical assumption that student behavioral types are stable characteristics of individual students (Pascarella & Terenzini, 2005). This study will use longitudinal data of student engagement to investigate student typology. Guided by behavioral consistency theory, this study explores the supportive elements of educational settings in order to find those under which students' behavior-based types are more likely to change to a preferred type. Utilizing data resources from the combined student survey data from the Beginning College Student Survey of Student Engagement (BCSSE) and the National Survey of

Student Engagement (NSSE), this research will answer the following questions:

1) What are the student typologies in high school and first year of college?

2) Are students' background characteristics associated with student types?

3) Do students change from one type to the other? What is the general pattern?

4) Do institutional environment play a role in the stagnation or shift of engagement types?

Literature Review

Extant literature can broadly be group into two approaches for classifying college students (Hu & Li, 2011). One group of theories creates taxonomies personality-based approaches to learning (e.g., Kolb, 1981). The other approach groups students based on the similar behaviors exhibited (e.g., Hu & McCormick, 2012).

Personality-based approaches to academic behavior

The two of the more common approaches to using personality to studying to approaches to learning in higher education includes David A. Kolb's theory of learning style and experiential learning (1981) and John Holland's theory of vocational personalities (1992). Kolb's (1981) theory of learning style holds three notions: (1) one's learning style is relatively stable, as it forms from hereditary factor and cumulated experiences; (2) academic disciplines attract students of specific learning style; and (3) college experience continues to reformulate one's learning style. John Holland raised the theory of vocational personalities which states, "In our culture, most persons can be categorized as one of the six types: realistic, investigative, artistic, social, enterprising, or conventional" (1992, p. 2). Holland constructed an environmental model that is parallel to personality types. This model assumes, for a particular type of environment, its majority members have a personality of that type. For example, most people of a social environment are the social type. One limitation of these former personality based approaches is

the role of the environment or situation to understand changes in student typologies. As noted by Sherman, Nave, and Funder (2010), "situations powerfully influence behavior" (p330).

Behavior-based Typological Models

Research on behavior-based college student typologies has received increased attention starting in the 1960's and more recently, in the wake of student engagement surveys, has led to "behaviorally anchored typologies" (Hu et al., 2011; Hu & McCormick, 2012; Kuh et al., 2000; Pike & Kuh, 2005). The intuitive appeal for creating such typologies was best exclaimed by Astin (1993a) when he stated, "it is virtually impossible to carry on a meaningful conversation about American college students without invoking taxonomic language" (p. 36).

Several recent studies have successfully identified several college student types. For instance, Kuh et al (2008) utilized data from College Student Experience Questionnaire (CSEQ) to identify ten student types: individualist, grind, disengaged, intellectual, scientist, socializer, artist, recreator, collegiate, and conventional. More recently, Hu and McCormick (2012) used cluster analysis to identify seven types of college students using data from the National Survey of Student Engagement (NSSE): academics, unconventionals, disengaged, collegiates, maximizers, grinds, and conventionals. Though these studies shed light how groups of students engage with learning environments, they share a common limitation in that they relied on data from one-time cross sectional assessments. The limitation of course is that we are left to ponder the stability or consistency of student behaviors as the academic year progresses. As noted by Astin and Lee (2003), "one-shot cross-sectional assessments of enrolled college students are very difficult to interpret unless the institution also has access to relevant information about these same students when they first entered college" (p. 669), including their past educationally relevant behaviors.

Theoretical Framework

It is intuitive that students display similar behavioral characteristics at different periods during their school career. This notion of "behavioral consistency" is not new and has been the subject of research, though very little in higher education research.

Behavioral Consistency

Researchers have long noticed people's behaviors tend to be fairly consistent (Funder & Colvin, 1991), lending support to a personality-based approach to understanding behavioral consistency. However, research has also shown the malleability of academic behaviors. Behavioral consistency is generally categorized into three types: absolute consistency, relative-position consistency, and ipsative consistency (Sherman, Nave, & Funder, 2010).

The strictest form of consistency, or *absolute consistency*, is defined as "displaying the same behavior across time and situations" (Sherman et al., 2010, p. 332). This type of behavioral consistency rarely demonstrates in daily life. This approach assumes that behaviors are immune to the influences of the situation. For instance, it would not be expected that a student would ask the exact number of questions in class between different classes or across the semesters.

The second type of consistency is relative-position consistency (aka, rank order consistency), which regards the relative level of one's behavior enactment comparing with others across situations. Relative-position consistency recognizes the influence of the situation as a determinant, but also recognizes consistency of relative order of individuals compared others. For instance, John may be the 5th most talkative person in class and the 5th most talkative person in a group watching a football game, yet John talked a lot more watching the football game than at class.

Ipsative consistency compares relative consistency for within-person behaviors (Fleeson

& Noftle, 2008). Ipsative consistency compares across behaviors within an individual. For instance, John talks more than listens, regardless of being in class or watching a sporting event. In other words, the relative position of those two behaviors for John does not change even though the situation does change.

Behavioral Consistency and Environment

Behavioral consistency is related with one of the fundamental assumptions of social psychology, which states, "Each individual is characterized by a set of qualities that does not change from situation to situation and that these invariant qualities are expressed in the behaviors of individuals." (Shoda, 1999a, p. 155) Years of research showed that although there is association between an individual's behaviors at different situations, the correlation is only moderate (Shoda, 1999b). Situation acts as a natural alternative to personality that determines behaviors (Fleeson & Noftle, 2008).

The variability of behaviors across different contexts does not violate behavioral consistency, but implies the importance of situation in analyzing people's behaviors: The pattern of behaviors depends on where the person displays it. In another words, the underlying characteristics urge a person to behave differently across situations, but under similar situations, the behaviors still show some level of consistency (Mischel, 2004). Psychological studies documented the impact of situational similarity on behavioral consistency (Fleeson & Noftle, 2008; Furr & Funder, 2004; Sherman et al., 2010). Sherman et al. (2010) found that situational similarity was positively associated with behavioral consistency, especially when the participants themselves rated the situations as similar. Mischel (2004) argued, "These *if..then…*situation-behavior relationships provide kind of 'behavior signature of personality'that identifies the individual and maps on the impressions formed by observers about what they are like" (p. 8).

Behavioral Consistency in Higher Education Research

In higher education studies, researchers have long noticed the impact of environment on people's behaviors. The foundational theories of college student engagement, such as Astin's I-E-O model, Pascarella's general model for assessing change, Weidman's model of undergraduate socialization, all reflect that student's engagement is highly affected by the environment. Measures of interest in these studies usually contain students' previous education experience, academic performance, parents' educational level, all implying that the previous behaviors have significant impact on students' performances/engagement in higher education institutions.

Although the term was rarely mentioned, student-learning theories all reflect the notion of consistency in students' behaviors from the period before college to the time they graduate. This is the case in Astin' I-E-O model, Pascarella's general model for assessing change, Weidman's model of undergraduate socialization. In common, these theories all assume that student input impacts student outcomes. One aspect of student input is students' learning habits formed before entering college. Student outcomes not only contain concrete ones like getting a job or certificate but also behaviors in life and work environment (Astin, 1977; Wilson, 1966). Their behaviors in school reflect their later behaviors in life and work.

As mentioned in the theoretical framework, the current study is guided by the notion of behavioral consistency, more specifically ipsative consistency, meaning within student behaviors should have some level of consistency or occur in similar patterns relative to other similar within student behaviors, although the frequencies and performances may have change.

The proposed model in this study has two parts. The lower half relates to research question 1 (What are the student typologies in high school and first year of college) and 3 (Do students change from one type to the other? What is the general pattern?). The questions focus on the

classification of student behavior and changes that occur from pre-college to end of first year. Based on behavioral consistency, it is expected most students remain in the same type from pre-college to the end of the first year in college.

The second part of each model is to answer the other research questions and explore how the student types are associated with student background characteristics, high school/ institutional environment. These explorations capture Mischel (2004) argument of "if..then" situation-behavior relationships. To clarify, in the investigation of behavioral consistency, I assume there is no sharp interruption during the process. This means the impacts of critical life events are beyond the discussion of the current study.

Transition from High School to College

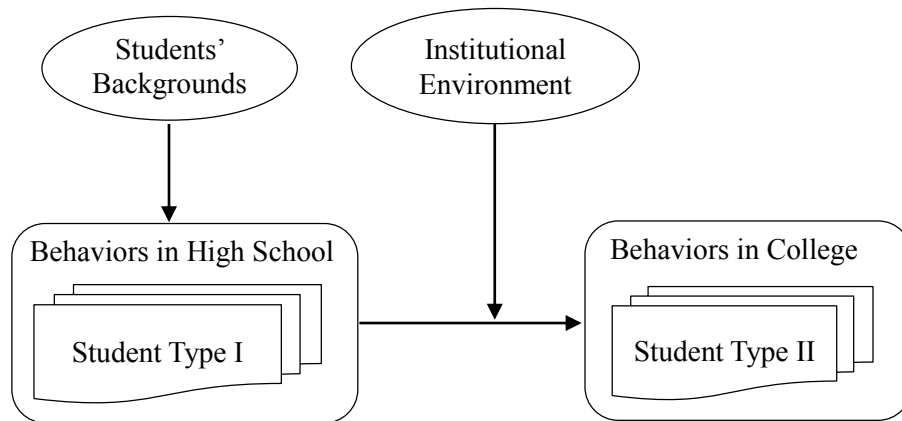*Figure 1.* A Conceptual Model

Methods

Data Source

The data source for the current study is a combined dataset from two national college student surveys—National Survey of Student Engagement (NSSE) and its parallel survey Beginning College Survey of Student Engagement (BCSSE). NSSE launched in 1999, investigating college students' participation in multiple educational purposeful activities. It is

now a complete online survey conducted to first-year and senior students. The NSSE

administration opens in spring and closes in June. BCSSE asks beginning college students about

their engagement in high school and expected involvement during the first of college.

Participating schools of BCSSE can choose paper or online format. For both surveys, the center

provides comprehensive assistance to participating institutions at every stage of the survey, such

as survey invitation, reminder, and delivery. The standard process ensures the validity for inter-

institutional comparison. In recent years, around six hundred higher education institutions take

part in NSSE and more than one hundred colleges and universities join in BCSSE annually. The

types of participating schools have a good resemblance to the national distribution.

This study used data of the U.S. undergraduates who responded to both BCSSE and the

following NSSE administered at the *same* institution during the *same* academic year. In analysis,

we merged five BCSSE-NSSE combined datasets administered between 2007 and 2012. To

prevent different administration formats adding unexpected measurement errors to students'

responses, the study utilized data from students who responded to both surveys' online format.

The final sample included 20,105 students from 145 U.S. colleges and universities. Chi-square

analysis was conducted to test sampling distributions of sex, racial/ethnical groups, and

enrollment status (full-time vs. part-time) of the datasets from different academic years. The

results showed that the datasets are reasonable to be combined for analysis.

Variables

To make the typology reflect observable student behaviors, variables for classifying

students only included student behavior frequencies in social and academic engagement. The

items covered student's engagement in active and collaborative learning, interaction with faculty,

discussion with other from diverse backgrounds, and course challenge. To facilitate analysis, I

collapsed the original four response options into two categories. Before analysis, the original

response options "never" and "sometimes" were recoded into "never/sometime", while "often"

and "very often" were combined as "often/very often". Table 1 illustrates variables and

frequencies of the option "often/very often".

Table 1. Frequency and Percentage of Response Option "Often/Very Often" ($N=20,105$)

	Freq.	%
BCSSE		
Ask questions in class or contributed to class discussions	16,003	80
Made a class presentation	11,523	57
Discuss grades or assignments with a teacher/instructor	10,379	52
Work with other students on projects during class	13,405	67
Work with classmates outside of class to prepare class assignments	7,149	36
Prepared two or more drafts of a paper before turning it in	9,536	47
Have serious conversations with students of a different race	9,887	49
Discuss ideas from your readings or classes with teachers outside of class	5,661	28
Discuss ideas from your readings or classes with others outside of class	10,674	53
Talk with a faculty member about career plans	12,134	60
Have serious conversations with students who are very different from you in terms of their religious beliefs, political opinions, or personal values	10,513	52
NSSE		
Ask questions in class or contributed to class discussions	12,707	63
Made a class presentation	6,477	32
Discuss grades or assignments with a teacher/instructor	9,916	49
Work with other students on projects during class	8,014	40
Work with classmates outside of class to prepare class assignments	9,091	45
Prepared two or more drafts of a paper before turning it in	10,771	54
Have serious conversations with students of a different race	9,988	50
Discuss ideas from your readings or classes with teachers outside of class	4,111	20
Discuss ideas from your readings or classes with others outside of class	11,817	59
Talk with a faculty member about career plans	6,527	32
Have serious conversations with students who are very different from you in terms of their religious beliefs, political opinions, or personal values	11,291	56

Analysis Methods

We analyzed the relationships in the conceptual model in three steps. Latent class

analysis (LCA) were done first to find the optimal number of classes beginning college students

and end-of-first-year college students in the BCSSE-NSSE dataset (Collins & Lanza, 2010).

Next, latent transition analysis (LTA) took the number of classes from LCA to explore the

transition of class membership between the two data sets. At last, we added students' background

characteristics (sex, race/ethnicity, first-generation college student status) as control variables,

and supportive campus environment, institutional characteristics (basic Carnegie classification)

as covariates to the LTA models.

LCA is based on traditional structural equation model (SEM) which usually uses multiple

observable measures to construct a hypothetical concept (Muthén, 2002). Different from

traditional SEM, LCA is a latent variable model in which both the latent and observed variables

are categorical (Muthén, 2002). It is a convenient method for describing the general pattern of

categorical responses in a parsimonious and comprehensive way. LCA divides a sample into a

limited number of exhaustive and exclusive groups. In LCA models, each group is called a latent

class.

Different from traditional SEM that uses variance-covariance matrix for analysis, LCA

analyzes the contingency table by the categorical observed variables. Let j=1, j, …, J represents

observed variables. If each variable has Rj response categories, the contingency table will have

$W = \prod_{j=1}^{J}$Rj cells. Each cell in the contingency table is a unique response pattern, denotes as **y** =

(r_1, …r_J) (Collins & Lanza, 2010). The purpose of LCA is to get latent class prevalence, which is

the distribution of groups (referred to as γ), and item-response probabilities (ρ), which is the

probability of response option r_j of variable j conditional on latent class membership. Each

vector of the contingency table has a probability:

$$P(Y = y) = \sum_{c=1}^{C} \gamma_c \prod_{j=1}^{J} \prod_{r_j=1}^{R_j} \rho_{j,r_j|c}^{I(y_j=r_j)}$$

The preliminary analysis was conducted using SAS package PROC LCA and PROC LTA

(The Methodology Center Penn State University, 2015). These two packages use EM algorithm

and maximum likelihood to estimate parameters (Lanza, Dziak, Huang, Wagner, & Collins, 2015). When I get the results, I need to evaluate the item response probabilities. If the item response probabilities vary among latent classes and the probabilities close to 0 and 1, these mean the item can distinguish latent classes well. With this procedure, LCA not only finds the ideal number of classes but also examine the efficiency of the observed variables in distinguishing classes. These results are the basis for LTA.

LTA is an extension of LCA, which not only estimates the prevalence of membership but also the change of the membership over time. In LTA, the latent class is renamed *latent status*, indicating its changeable feature from one time to another. Using LTA, researchers are able to tell the latent status prevalence and transition probabilities. LTA allows researchers to constrain the transition parameters in order to examine research hypotheses (Collins & Lanza, 2010).

LTA has parameters of the latent status prevalence and item response probabilities that are parallel to those in LCA. The additional set of parameters to estimate is transition probabilities. Let δ_{st} denotes the probability of latent status s at Time t. For a given time t,

$$\sum_{st=1}^{S} \delta st = 1$$

As traditional SEM, LTA can contain covariates. The current study has two waves of survey from each data resource. In each model shown in Figure 1, there are two groups of covariates, students' background characteristics, and institutional/school environment characteristics. LTA can be written as

$$P(Y = y|X_1 = x_1, X_2 = x_2) = \sum_{S1=1}^{S} \sum_{S2=1}^{S} \delta s1(x_s) \prod_{j=1}^{J} \prod_{r_j=1}^{R_j} \rho_{j,r_j|c}^{I(y_j=r_j)}$$

Where X_1 denotes student's background characteristics, X_2 denotes institutional characteristics.

Compared with other methods used in studies of college student typology, such as factor analysis and cluster analysis, LCA and LTA have evident advantages. In contrast with factor analysis, using LCA and LTA models, each case belongs to one and only one class/status. In addition, the computation of latent classes is built on all the observed indicators rather than a few variables that have the highest loadings. LCA also has some attracting attributes making it outdo cluster analysis. It offers multiple statistics for model fit, such as Akaike information criterion (AIC) and Bayesian information criterion (BIC), contrasting with the arbitrary way in cluster analysis. Researchers do not need to standardize observed indicators before analysis when doing LCA/LTA. More advanced than cluster analysis, LCA and LTA also allow covariates in the model (Magidson & Vermunt, 2002).

Results

Table 2 presents the results of LCA models up to six statuses with high school and first-year surveys. The values of fit statistics continued to decrease with an addition of class. Yet, as Figure 1 and 2 show, the fit statistics leveled out from the four-status model. This is common for these types of models (Kam, Morin, Meyer, & Topolnytsky, 2013). The decreases reached a plateau around four classes. As the four-class model has greater parsimony and interpretability, we chose it as the basis for LTA models.

Table 2.
Fit Statistics of LCA Models from 1 to 6 Classes (N=20,105)

| Classes	1	2	3	4	5	6
BCSSE						
Log-likelihood	-143,840	-135,028	-133,977	-132,898	-132,467	-132,279
G-squared	26,491	8,867	6,766	4,608	3,746	3,370
AIC	26,513	8,913	6,836	4,702	3,864	3,512
BIC	26,600	9,095	7,113	5,074	4,330	4,074
CAIC	26,611	9,118	7,148	5,121	4,389	4,145
Adjusted BIC	26,565	9,022	7,001	4,925	4,143	3,848
Entropy	1	1	1	1	1	1
Df.	2,036	2,024	2,012	2,000	1,988	1,976
Seeds with best fitted model	100%	100%	50%	100%	100%	20%
NSSE						
Log-likelihood	-144,345	-134,652	-132,095	-131,034	-130,676	-130,466
G-squared	31,048	11,661	6,546	4,426	3,709	3,289
AIC	31,070	11,707	6,616	4,520	3,827	3,431
BIC	31,157	11,889	6,893	4,892	4,293	3,992
CAIC	31,168	11,912	6,928	4,939	4,352	4,063
Adjusted BIC	31,122	11,816	6,782	4,742	4,106	3,767
Entropy	1.00	0.70	0.72	0.69	0.67	0.62
Df.	2,036	2,024	2,012	2,000	1,988	1,976
Seeds with best fitted model	100%	100%	70%	100%	90%	70%
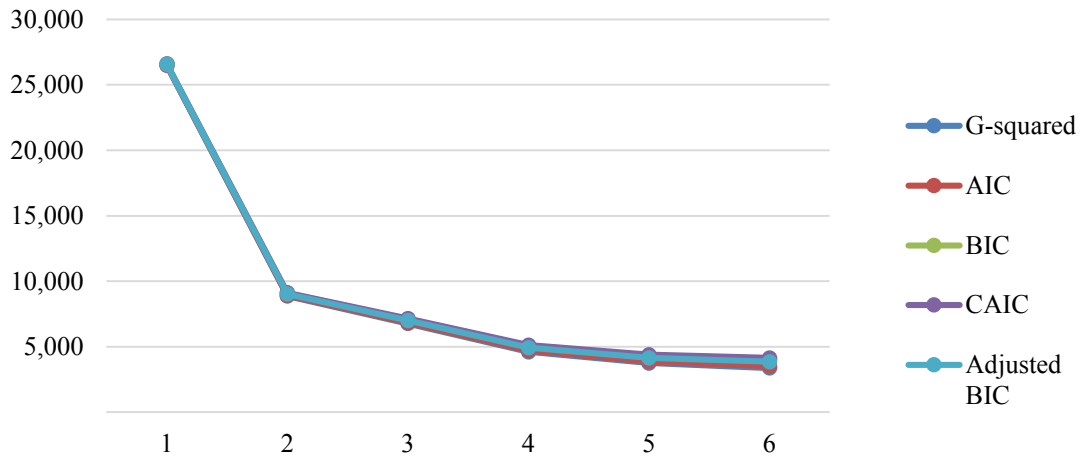
Figure 2. Beginning College Students LCA Fit Statistics by Number of Classes
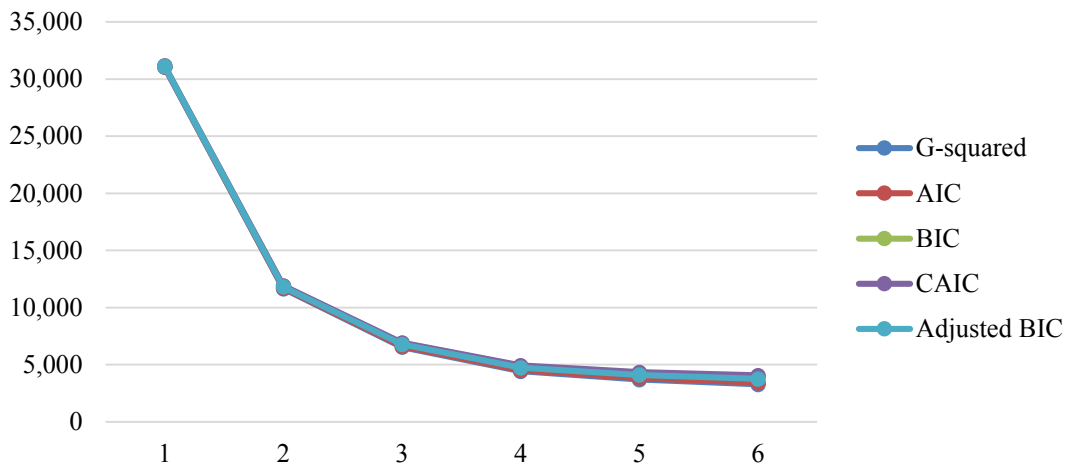

Figure 3. End-of-first-year Students LCA Fit Statistics by Number of Classes

Table 3 and Table 4 illustrate class membership probabilities and the conditional item probabilities for each item from 4-class LCA model for beginning and end-of-first-year students respectively. The class membership probabilities were all close to 25%, showing the types had a reasonable distribution. By comparison, the largest group of entering college students were Typical, while Socially Engaged had the largest proportion of first-year college students.

The conditional item probabilities illustrate the level of engagement by different types of students in a variety of activities at high school and the first year of college. The Disengaged and Proactive stood on the opposite ends of the spectrum. Students in the Disengaged group were

least frequently participating any of these activities, while the Proactives had the highest

frequencies in all activities. The other two types showed clear tendencies in some aspects. The

Typical type of students seemed to care more about their academic performances, especially the

performances in class. They were active in asking questions in class and often approached the

teachers. In contrast with Typical, the Socially Engaged were keen to have discussions with

people of different backgrounds. However, they were lukewarm in contacting with instructors or

presenting in class. The four-group classification demonstrates strong explainability. For the

entering and first-year college students, a type may have distinguished frequencies of activities

but the characteristics were stable for all the four types.

Table 3.
Entering College Students Four-Class LCA Model: Class Membership Probabilities and Item Response Probabilities on "Often/Very often"

	Disengaged	Proactive	Socially Engaged	Typical
	0.22	0.24	0.26	0.28
	(0.01)[†]	(0.01)	(0.01)	(0.01)
Ask questions in class or contributed to class discussions	0.53	0.97	0.80	0.87
	(0.01)	(0.00)	(0.01)	(0.01)
Made a class presentation	0.24	0.87	0.49	0.68
	(0.01)	(0.01)	(0.01)	(0.01)
Discuss grades or assignments with a teacher/instructor	0.19	0.85	0.41	0.61
	(0.01)	(0.01)	(0.01)	(0.01)
Work with other students on projects during class	0.38	0.89	0.60	0.78
	(0.01)	(0.01)	(0.01)	(0.01)
Work with classmates outside of class to prepare class assignments	0.08	0.68	0.24	0.41
	(0.01)	(0.01)	(0.01)	(0.01)
Prepared two or more drafts of a paper before turning it in	0.27	0.70	0.39	0.54
	(0.01)	(0.01)	(0.01)	(0.01)
Have serious conversations with students of a different race	0.18	0.81	0.76	0.23
	(0.01)	(0.01)	(0.01)	(0.01)
Discuss ideas from your readings or classes with teachers outside of class	0.02	0.72	0.22	0.19
	(0.00)	(0.01)	(0.01)	(0.01)
Discuss ideas from your readings or classes with others outside of class	0.20	0.90	0.61	0.43
	(0.01)	(0.01)	(0.01)	(0.01)
Talk with a faculty member about career plans	0.33	0.86	0.55	0.68
	(0.01)	(0.01)	(0.01)	(0.01)
Have serious conversations with students who are very different in terms of their religious beliefs…	0.13	0.87	0.88	0.21
	(0.01)	(0.01)	(0.02)	(0.02)

Note: † standard errors in parentheses

Table 4.

End-of-first-year College Student Four-Class LCA Model: Class Membership Probabilities and Item Response Probabilities on "Often/Very often"

	Disengaged	Proactive	Socially Engaged	Typical
	0.28	0.20	0.35	0.18
	(0.01)	(0.01)	(0.01)	(0.01)
Ask questions in class or contributed to class discussions	0.37	0.91	0.62	0.77
	(0.01)	(0.01)	(0.01)	(0.01)
Made a class presentation	0.14	0.63	0.23	0.45
	(0.01)	(0.01)	(0.01)	(0.01)
Discuss grades or assignments with a teacher/instructor	0.19	0.92	0.38	0.72
	(0.01)	(0.01)	(0.01)	(0.01)
Work with other students on projects during class	0.21	0.67	0.34	0.51
	(0.01)	(0.01)	(0.01)	(0.01)
Work with classmates outside of class to prepare class assignments	0.22	0.77	0.41	0.56
	(0.01)	(0.01)	(0.01)	(0.01)
Prepared two or more drafts of a paper before turning it in	0.41	0.75	0.47	0.66
	(0.01)	(0.01)	(0.01)	(0.01)
Have serious conversations with students of a different race	0.08	0.89	0.80	0.14
	(0.01)	(0.01)	(0.01)	(0.01)
Discuss ideas from your readings or classes with teachers outside of class	0.01	0.65	0.08	0.26
	(0.00)	(0.01)	(0.01)	(0.01)
Discuss ideas from your readings or classes with others outside of class	0.30	0.90	0.66	0.58
	(0.01)	(0.01)	(0.01)	(0.01)
Talk with a faculty member about career plans	0.08	0.76	0.20	0.48
	(0.01)	(0.01)	(0.01)	(0.01)
Have serious conversations with students who are very different in terms of their religious beliefs…	0.10	0.95	0.91	0.20
	(0.01)	(0.01)	(0.01)	(0.02)

Note: † standard errors in parentheses

Table 5 shows the transition probabilities from entering college to the end of the first year in college. As we can see, the majority students of each of the four groups remained in the same type at the end of the first year in college as they were in high school. The Proactive and Typical groups had relatively larger mobility. Although it seems a student can be of any other type in college, the transition probabilities reveal some tendencies. Only 7% of those students who were in the Disengaged group were Proactive in college. Meanwhile, only 10% of the Proactive shifted to the Disengaged group during the first year in college. Students who were Socially Engaged in high school were more likely to be the Disengaged than in the Typical group. In

contrast with the other three groups, students who were Typical in high school, if they did not

remain in the same type in college, had almost equal odds to be in the other group.

Table 5.
Entering Latent Status (row) by End-of-first-year Latent Status (column) Transition Probabilities

	Disengaged	Proactive	Socially Engaged	Typical
Disengaged	0.67	0.04	0.16	0.14
Proactive	0.06	0.48	0.32	0.15
Socially Engaged	0.15	0.11	0.68	0.06
Typical	0.23	0.17	0.15	0.45

In the LTA model, we added student background characteristics, including gender, first-

generation-college-student status, and racial/ethnic identity, to predict student's type when they

were high school students. The results (Table 6) indicate these background characteristics were

strongly associated with student typology. The estimations can be considered as coefficients in

logistic or multinomial models (Lanza & Collins, 2008). Compared with the female, male

students were more likely to be in Disengaged, Proactive, or Socially Engaged group than in the

Typical group. Holding all other situations constant, the odds of first-generation college students

being in the Disengaged group relative to the Typical group was 1.18 times the odds of non-first-

generation college students. Meanwhile, the odds of first-generation college students being in the

Socially Engaged group to the Typical was 0.69 times the odds of non-first-generation college

students. In general, students of different racial/ethnic groups performs a unique pattern of

shifting from one group to the Typical group. For example, using the White as reference group,

we found the odds of the Black students shifted from Disengaged to Typical was 0.62 times that

of the White students, while for the same shift direction, the odds of Asian was 1.14 times of the

White.

Table 6.

Odds Ratio Estimates of Covariates on Entering Student Types (Typical as Reference Group)

Status	Disengaged	Proactive	Socially Engaged
Intercept(odds)	0.80	0.74	0.87
Male	1.33	1.16	1.40
First-gen status	1.17	0.88	0.67
Race (White as reference group)			
African American/Black	0.58	1.70	0.70
American Indian/Alaska Native	0.69	1.97	1.06
Asian/Pacific Islander	1.35	1.64	2.04
Hispanic	0.81	1.53	1.35
Foreign	0.75	1.12	0.70
Multi	0.90	2.34	2.19

Table 7.

Percentage of Entering Student Type by Background Characteristics (N=20,105)

	Disengaged	Proactive	Socially Engaged	Typical
Female	22.1	24.4	24.8	28.7
Male	24.8	22.8	30.1	22.4
Not FG Student	22.2	23.8	27.5	26.5
First Gen Student	26.8	24.8	20.0	28.3
Race				
African American/Black	14.9	39.9	16.7	28.5
American Indian/Alaska Native	14.5	37.7	23.2	24.6
Asian/Pacific Islander	23.7	23.9	35.6	16.8
Caucasian/White	24.5	21.5	26.3	27.8
Hispanic	17.4	29.1	29.3	24.2
Foreign	21.7	28.3	19.9	30.1
Multi-racial/ethnic	15.9	30.7	38.3	15.2

Likelihood ratio test showed that the covariates of the transition were all statistically significant at 0.05 level. The effects of covariates on the transition of student types are shown in Table 8. The interpretation of these coefficients are not intuitive (Collins & Lanza, 2010). Each coefficient represents the ratio of two odds. Take the coefficient we denoted "a" for example. If we have two students who were both recognized as Disengaged using their engagement activities in high school. One is from a public institution and the other private. The odds of the student from public institution shifted to Proactive vs. remaining in the Disengaged group is P1, while

the odds of the student from private institution shifted to Proactive vs. remaining in the

Disengaged group is P2. P1/P2= a =0.52.

Table 8.
Odds Ratios for Institutional Environmental Characteristics on Transition from Entering college to the End of First Year

	Disengaged	Proactive	Socially Engaged	Typical
Intercept				
Disengaged	Reference	0.06	0.17	0.14
Proactive	0.14	Reference	0.74	0.41
Socially Engaged	0.19	0.10	Reference	0.10
Typical	0.55	0.31	0.38	Reference
Private institutions				
Disengaged	Reference	0.90	1.49	1.54
Proactive	0.35	Reference	0.68	0.93
Socially Engaged	1.02	1.42	Reference	1.25
Typical	0.56	0.93	0.76	Reference
Supportive Campus Environment(standardized)				
Disengaged	Reference	2.70	1.55	2.35
Proactive	0.22	Reference	0.40	0.48
Socially Engaged	0.51	2.50	Reference	1.15
Typical	0.41	1.77	0.69	Reference
Doctoral institutions				
Disengaged	Reference	0.20	1.15	0.67
Proactive	1.12	Reference	2.23	0.83
Socially Engaged	1.02	0.55	Reference	0.41
Typical	1.62	1.20	1.78	Reference
Master's institutions				
Disengaged	Reference	1.08	1.05	0.97
Proactive	1.07	Reference	0.85	0.88
Socially Engaged	0.96	1.04	Reference	0.73
Typical	0.94	0.94	0.73	Reference

Note: † public institutions are the reference group.
      ‡ baccalaureate institutions are the reference group.

To demonstrate the differences more intuitively, we calculated student memberships

based on their maximum posterior probabilities and generated the following cross-table to show

the transition and distribution of student type by institutional characteristics. The results show,

comparing with other institutions, students who entered a baccalaureate college were less likely

to remain in the Disengaged type.

Table 9.
Percentage of Student Types by Institutional Environmental Characteristics on Transition from Entering college (row) to the End of First Year (column) (N=20,105)

	Disengaged	Proactive	Socially Engaged	Typical
bachelor colleges				
Disengaged	64.1	4.5	19.5	11.9
Proactive	4.1	57.8	18.0	20.0
Socially Engaged	15.2	13.9	63.7	7.2
Typical	17.6	20.3	13.5	48.6
Master's colleges				
Disengaged	66.5	4.6	19.6	9.3
Proactive	6.0	57.7	19.0	17.2
Socially Engaged	17.2	12.1	64.9	5.7
Typical	20.3	19.7	11.5	48.5
Doctoral				
Disengaged	69.5	0.8	22.1	7.7
Proactive	4.7	42.1	41.0	12.2
Socially Engaged	18.7	8.0	69.9	3.4
Typical	28.2	17.4	22.7	31.7
Private				
Disengaged	62.2	3.8	22.2	11.8
Proactive	2.9	58.4	20.8	17.8
Socially Engaged	15.2	13.5	64.7	6.5
Typical	16.8	21.4	13.3	48.4
Public				
Disengaged	72.9	3.3	17.2	6.6
Proactive	8.9	43.8	33.1	14.1
Socially Engaged	20.5	7.3	68.8	3.4
Typical	29.3	15.8	17.7	37.2

Table 10.
Means of Supportive Campus Environment by the Student Type Transition from Entering college (row) to the End of First Year (column)

	Disengaged	Proactive	Socially Engaged	Typical
Disengaged	-0.76	0.91	0.31	-0.25
Proactive	-1.14	0.94	0.35	-0.47
Socially Engaged	-0.91	1.09	0.29	-0.66
Typical	-0.86	0.82	0.39	-0.28

Discussion

Using longitudinal dataset from Beginning College Survey of student Engagement and National Survey of Student Engagement, our study show that both high school and college students can be classified into four types based on their behaviors in educationally purposeful

activities, such as interactions with faculty members and classmates. Tracking students' types at high school and the end of first year, we further find a majority of students remain in the same type in colleges and universities as they are in high school. Students' types in high school are significantly associated with students' background characteristics, including gender, first-generation status, and racial/ethnical groups. The shift from one student type in high school to another type in college is correlated with higher education institutions' structural features, like control (private vs. public), Carnegie classification, and individual students' perceived supportive campus environment. In the following, we discuss these findings in details.

First, using typical students' behaviors in high school and higher education settings, we obtained a succinct and generalizable student typology, which contains Disengaed, Socially Engaged, Proactive, and Typical. This classification is basically in accordance with previous behavior-based typology studies (Hu & McCormick, 2012; Kuh et al., 2000; Zhao et al., 2003), For example, the Disengaged in our model is parallel to the Disengaged, the Typical to the Conventionals, the Proactive to the Maximizers, the Socially Engaged to the Unconventionals in the typology proposed by (Hu & McCormick, 2012). The major difference with previous studies is that most of previous studies utilizes summary measures as bases of classifying students. For instance, Kuh et al. (2000) used factor scores from factor analysis before conducting cluster analysis. Similarly, Hu and McCormick (2012) applied cluster analysis on NSSE benchmarks which are parallel to factor scores. In contrast, we group students based on their specific behaviors. With this method, we try to maintain most variation in students' behaviors. Another difference of our model is the fewer types compared with previous studies (Hu & McCormick, 2012; Kuh et al., 2000; Zhao et al., 2003). We aim to obtain a succinct model and generally consistent with the theoretical model proposed by Clark and Trow (1966).

Another contribution of the current study is the longitudinal design that enables us to uncover the connection of student types in high schools and those in higher education institutions. We find that most students remained in the same type as they are in high school after one year in college. This phenomenon can be explained using behavioral consistency, which states one's behaviors have relative stable pattern in different contexts (Fleeson & Noftle, 2008). The finding force us to rethink about current efforts by colleges and universities for promoting student engagement. To foster an ideal behavioral pattern, high schools and higher education institutions shall take on the responsibilities mutually. High schools, which typically lack the diverse learning atmospheres, shall best utilize available resources to encourage students to participate extracurricular activities that will benefit students' learning in postsecondary schools and whole-person development in their later life.

Having said that, it does not mean higher education institutions have little to do to alter students' types. We found an institution's structural characteristics, such as control and Carnegie classification, are correlated with students' shift between types. Students who enter a doctoral institution are less likely to remain in the Proactive group after one year in college. So is the case if they enter a public institution. Perhaps, the extensive campuses and rigid atmosphere of doctoral and public universities and colleges hinder students to be proactive as they used to be.

A more significant indicator of student type shifts is individual student's perceived supportive campus environment. Here we define a supportive campus environment as the campus provides students with adequate support for the academic, social and other needs and students have good relationship with their peers, faculty members and administrators. If that students actively participating in all aspects of campus life is a status we want, holding other situations constant, students who perceived a very supportive campus environment are more

likely to shift from other types to Proactive, while student who are Proactive group in high

school are more likely to remain in the same type. The causes of these differences between

institutions in students' shifts of types have to be explored with methods that are more cautious.

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Appendix I. Log-Likelihood Ratio Test of Covariates

Log-Likelihood Ratio Test of Covariates (*Full model: LL=-259261.22)*

	Log-likelihood	Change of 2*LL	df	p-Value
Carnegie	-259349.97	177.50	24	<.001
Control	-259299.11	75.78	12	<.001
ZSCE	-260760.43	2998.42	12	<.001
Gender	-259280.22	38.00	3	<.001
FGhs	-259291.03	59.62	3	<.001
race_Bla	-259339.74	157.04	3	<.001
race_Ind	-259268.82	15.20	3	0.002
race_Asi	-259278.32	34.20	3	<.001
race_His	-259285.17	47.90	3	<.001
race_For	-259265.07	7.70	3	0.053
race_mul	-259277.64	32.84	3	<.001

Appendix II. Supportive Campus Environment Benchmark

- Providing the support you need to thrive socially

- Providing the support you need to help you succeed academically

- Helping you cope with your non-academic responsibilities (work, family, etc.)

- Relationships with other students

- Relationships with faculty members

- Relationships with administrative personnel and offices