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This chapter describes a typology of first-time community college students based on students' course-taking and enrollment behavior. The utility of the typology is demonstrated through an application that involves interpreting data concerning students' participation in remedial mathematics.

A Typology of Students' Use of the Community College

Peter Riley Bahr

Owing to the multifaceted nature of their mission, community colleges draw students of extraordinarily diverse backgrounds, with widely varying levels of academic preparation, pursuing a range of academic objectives from a baccalaureate degree (by upward transfer to a four-year institution) to personal enrichment, and everything in between (Adelman, 2005a; Bahr, 2010a; Goldrick-Rab, 2010; Hoachlander, Sikora, and Horn, 2003; Kim, 2002; Kim, Sax, Lee, and Hagedorn, 2010; Laanan, 2000; VanDerLinden, 2002; Voorhees and Zhou, 2000). On the one hand, the broad range of student aspirations and characteristics found in community colleges is an indicator of both the democratizing role of community colleges in the United States (Dowd, 2003) and the role of community colleges as the local institutions of higher education for their communities (Noftsinger and Newbold, 2007; Shaw and Jacobs, 2003; Wang, 2004). On the other hand, the great variation in the student population makes the effective delivery of student services and support a daunting task indeed (Hagedorn, 2010; Shannon and Smith, 2006), even as it also complicates greatly the measurement of institutional performance in that regard (Bahr, 2011; Bahr, Hom, and Perry, 2004, 2005; Bailey and others, 2006; Dowd, 2007; Lane, 2003; Seybert, 2002).

Consequently it perhaps is not surprising that there is a high level of interest in methods of differentiating and identifying types of community colleges students: the varied answers to who is enrolling in a given community college, how they are using the community college, and to what

Published online in Wiley Online Library (wileyonlinelibrary.com) • DOI: 10.1002/ir.415

end they are using it (Bahr, 2010a; Horn, 2009; Marti, 2008). In this era of declining resources and escalating expectations, answering these questions is crucial for all community college stakeholders—practitioners, administrators, policymakers, instructors, and researchers—if we are to understand and address appropriately the needs of each student subgroup. In fact, a clear picture of the different segments of the community college student population is key to the effective and efficient provision of services (Astin, 1993; Saenz and others, 2010; Santibáñez, Gonzalez, Morrison, and Carroll, 2007; Schuck and Zeckhauser, 2008). Likewise, increased clarity regarding variation in student composition, both across institutions and within a single institution over time, provides a foundational context on which to build understanding of institutional performance (Bahr, 2011; Bahr, Hom, and Perry, 2004, 2005; Dellow and Romano, 2002; Hoachlander, Sikora, and Horn, 2003). Given improved understanding about the ways in which students use a particular community college and to what ends they use it, stakeholders will be better able to determine how and to what extent the institution itself is helping and hindering students in their academic pursuits.

Bahr's Behavioral Classification Scheme

In a recent publication, I (Bahr, 2010a) used the cluster analytic methods described in Chapter Five in this volume to develop a classification scheme for first-time community college students based on students' course-taking and enrollment behaviors. This classification scheme included a number of important improvements and advancements over prior work on this topic (Adelman, 2005a; Ammon, Bowman, and Mourad, 2008; Hagedorn and Prather, 2005; VanDerLinden, 2002). Among these, I used an exceptionally large cohort of students and monitored students' behavior for a full seven years following entry into the system. I also was careful to distinguish between variables that are useful for identifying particular types of use of the community college system and, in contrast, variables that simply are correlated with particular types of use. Finally, I executed a number of tests of my findings to explore the efficacy and stability of the final cluster solution on which the classification scheme was based.

I (Bahr, 2010a) identified six major clusters of first-time community college students, which I labeled *drop-in*, *experimental*, *noncredit*, *vocational*, *transfer*, and *exploratory*. The drop-in cluster describes students who, on average, remain in the system for a very short period of time (two semesters), enroll in very few courses (about two courses total), and complete these courses successfully at an extraordinarily high rate (95 percent). The experimental cluster describes students who remain in the system for a comparably short period of time but enroll in heavier course loads (slightly more than half of a full-time course load on average) and complete these courses successfully at a very low rate (23 percent). The vocational cluster (perhaps better described as terminal vocational) encompasses students who remain in the system for a fairly lengthy period of time (seven semesters on average), take nearly full-time course loads, concentrate their course taking in nontransferable occupational courses, and succeed in these courses the majority of the time (79 percent on average). The noncredit cluster encompasses students who remain in the system a similar length of time but enroll almost exclusively in noncredit courses (Chancellor's Office, 2006) during their time in the system. The transfer cluster includes students who, on average, remain in the system longer than the students of any other cluster; they take full-time course loads, enroll in both the greatest number of units of course work overall and the greatest number of units of transferable math, English, and science courses; and succeed in their courses the majority of the time (77 percent on average).

The last cluster, which I (Bahr, 2010a) label *exploratory*, is the least transparent of the six. This cluster is similar to the transfer cluster with respect to the distribution of course-taking behavior, although students in the exploratory cluster exhibit a lower concentration of course taking in math and the physical and life sciences. Furthermore, they remain in the community college about half as long, on average, as do students in the transfer cluster, and they succeed in their coursework at a somewhat lower rate. In subsequent analyses, I demonstrated that students in the transfer and exploratory clusters are similar with respect to self-reported academic goals and that the behavioral profiles represented by the transfer and exploratory clusters actually are points on a continuum, as opposed to discrete (nonoverlapping) groups.

A Revision, Extension, and Application of Bahr's Classification Scheme

Despite the value of my approach to developing a classification scheme, this work exhibited some important limitations. Among these, some of the measures of student course-taking behavior that I employed were rather ambiguous, and others failed to capture important aspects of students' course taking, such as participation in remedial math and remedial English. In addition, the data on student course-taking and enrollment behavior were confined to the first community college attended by a given student, excluding from the analysis any course-taking and enrollment behavior at subsequent community colleges to which a student may have transferred laterally during his or her time in the system. Recent work (Bahr, 2009, forthcoming a) has demonstrated that lateral transfer between community colleges is quite common. Hence, this limitation of the data should not be underestimated.

Here, I seek to broaden and extend my previous work (Bahr, 2010a), presenting a revised classification scheme that corrects some of these weaknesses. I also seek to demonstrate the utility of a behavioral classification scheme for interpreting findings of significance for policy and practice. In particular, I examine how a behavioral classification scheme may inform the interpretation of findings concerning one especially prominent issue in many community colleges today: postsecondary remediation.

Data, Measures, and Methods

Data. In executing this revised classification scheme, I focused on the same fall 2001 first-time student cohort in the 105 semester-based community colleges in California that was the focus of my earlier (2010a) study. I also monitored the behavior of these students for the same eight-year period (through the summer 2009). This time, however, I tracked students' behavior across all of the semester-based community college rather than confining the analysis to behavior in the first institution. Thus, these data provide a complete picture of student behavior in the community college system, not just behavior in the first institution attended. I also executed a more rigorous identification and delineation of first-time students, excluding, for example, students whose entry into the community college system in fall 2001 was through a dedicated adult education center or continuing education center. Finally, I implemented an improved mechanism to capture and screen students' unique identifiers.

Measures. I retained several of the variables I employed in my classification scheme (Bahr, 2010a) but altered or replaced a number of the others in order to correct weaknesses evident in that earlier analysis. I retained the count of the number of noncredit courses a student attempted during participation in the community college system. I also retained the measure of the number of semesters (fall, spring, and summer) in which a student enrolled in at least one course (whether for credit or noncredit) in the community college system and the measure of the number of academic years in which the student enrolled in course work in at least one semester. Finally, I retained the mean course unit load per regular semester (fall and spring) and the ratio of courses completed successfully to courses attempted.

The remaining variables that I used in the earlier work (Bahr, 2010a) focused on the total number of units a student attempted in various areas of coursework during the student's time in the community college. Concerning these variables, I retained the measure of the total number of units attempted in all coursework and the measure of the number of units attempted in transferable physical and life science courses (for example, biology, chemistry, physics). I dropped the measure of the number of units attempted in transferable courses other than math, English, and science because this measure is ambiguous. For the same reason, I dropped my earlier measure of the number of units attempted in courses that were degree applicable but neither transferable nor occupational.

I previously (Bahr, 2010a) used a measure of the number of units attempted in transferable math courses. I replaced it with a measure of the number of units attempted in core math courses, resolving an important limitation that I had noted. I defined core math courses as those that are part of the remedial math sequence or deemed to be college level with respect to the general education math requirements of the California State University (CSU) or the University of California (UC) systems. Previously, I also used a measure of the number of units attempted in transferable English courses. I replaced it with a measure of the number of units attempted in core English courses, which I defined as English courses that are part of the remedial writing or remedial reading sequences or are deemed college level with respect to the general education composition requirement of the CSU or UC systems. My colleagues and I (Perry, Bahr, Rosin, and Woodward, 2010; Bahr, forthcoming b) provide a detailed discussion of these core courses in math and English.

In my earlier work (Bahr, 2010a), I used a measure of the number of units attempted in transferable social and behavioral science courses (for example, economics, psychology, sociology). I used a similar measure but redefined it to exclude courses that were categorized as core math courses. The most common exclusions were statistics courses offered in the sociology and psychology departments, which often satisfy general education math requirements in the CSU and UC systems.

I replaced my measure of the number of units attempted in nontransferable occupational courses with a measure of the number of units attempted in nontransferable vocational courses, such as business, commercial services, health occupations, and technological fields of various sorts. The distinction is a relatively minor one from an operational standpoint, but it ultimately broadens the contexts in which the measure is understood. I also created a new measure of the number of units attempted in transferable vocational courses. Finally, I created a measure of the number of units attempted in transferable humanities courses (for example, art, communications, languages), excluding core English courses.

I have not used any demographic measures or students' self-reported academic goal in the classification process either in my previous work (Bahr, 2010a) or now. Although I have demonstrated that students' course-taking and enrollment profiles vary by demographic characteristics, demographic characteristics are not suitable proxies of the various "uses" of the community college by students. In addition, students' self-reported goal has not proven to be a consistently reliable indicator of their actual use of the community college (Adelman, 2005b; Dowd, 2007; Hom, 2009).

Method of Analysis. Similar to my previous approach (Bahr, 2010a), I examined the distribution of values for each variable and recoded to equal the 99.9th percentile any value that exceeded the 99.9th percentile for that variable. I then standardized all thirteen variables, such that each variable had a mean of zero and a standard deviation of one, and applied

k-means cluster analysis using the Euclidean distance metric. I explored cluster solutions of $k = 4$ to $k = 10$ and, consistent with Bahr's findings, found the six-cluster solution to offer the optimal levels of cluster differentiation and parsimony. (For a detailed discussion of cluster analysis as it pertains to data that address community college students, see Chapter Five, this volume.)

Results

Despite the changes to the data and the variables employed in the cluster analysis, the results proved to be remarkably similar to my previous results (Bahr, 2010a). In Table 3.1, I present the mean of each variable within each cluster, as well as the mean of each variable in the fall 2001 first-time cohort as a whole. Leaving aside the fact that I find larger means on virtually every variable in every cluster, which is not surprising because I monitored student behavior across all of the semester-based community colleges in the system (accounting for lateral transfer), these statistics demonstrate within-cluster behavior that aligns very closely with that of my previous results. Hence, I applied labels to the clusters that largely are the same as my earlier labels.

Although it is encouraging from the standpoint of replication, the reemergence of the exploratory cluster in these findings is an interpretive conundrum. I had described the label that I applied to this cluster as "speculative" (Bahr, 2010a, p. 733), and I echo this description. As with the previous findings, I find the exploratory cluster to be similar to the transfer cluster in all respects except two. First, students in the exploratory cluster remained in the system for 43 percent fewer semesters on average and attempted 45 percent fewer course units. Second, students in the exploratory cluster attempted disproportionately fewer course units in math (56 percent fewer) and the physical and life sciences (67 percent fewer) on average. Based on these few differences, it perhaps is more accurate to describe the label applied to the cluster as exploratory rather than the cluster of behaviors itself because the exploratory cluster is both indistinct and comparatively large. Clearly further research and refinement of the analytical methods are needed to differentiate students who exhibit behavior that places them on the opposing ends of the continuum represented by the exploratory and transfer clusters.

An Application of the Classification Scheme

An effective behavioral classification scheme has great value for research, policy, and practice as it pertains to community college students, and I have detailed a number of ways in which such a scheme may be put to use by various community college stakeholders (Bahr, 2010a). Here, I seek to demonstrate the utility of a classification scheme with respect to

Table 3.1. Means of Enrollment Behaviors and Attempted Course Units for Each of the Six Clusters of First-Time Students and for All First-Time Students

	Student Cluster						
	Drop-In	*Experimental*	*Noncredit*	*Terminal Vocational*	*Transfer*	*Exploratory*	*All Students*
Number of semesters enrolled	2	2	13	9	13	7	5
Number of years enrolled	2	2	5	5	6	4	3
Mean unit load in regular semesters	3	7	2	10	11	11	7
Total units	7	16	22	82	123	67	42
Core math units	0	2	3	4	20	9	6
Core English units	0	2	3	4	14	8	5
Transfer physical/life science units	0	1	1	3	14	4	3
Transfer social/behavioral science units	0	2	2	5	23	13	7
Transfer humanities units	1	2	2	5	20	11	6
Transfer vocational units	2	4	4	12	19	13	8
Nontransfer vocational units	1	1	2	43	3	2	3
Count of noncredit courses	1	0	25	2	4	2	2
Course success ratio	0.94	0.26	0.96	0.80	0.73	0.71	0.66
N	44,976	41,613	1,977	4,165	20,638	34,577	147,946
Percentage of first-time student cohort	30%	28%	1%	3%	14%	23%	100%

Note: The measure of attempted course units in social and behavioral science courses does not include attempted course units in courses that are treated as core math courses, such as statistics courses offered in psychology or sociology that meet the general education math requirement in the California State University and University of California systems. The measure of attempted course units in transferable humanities courses does not include attempted course units in core English courses.

understanding one particularly thorny issue for community colleges: remediation in mathematics.

One of the more difficult and controversial problems community colleges face today is the enormous number of entering students who require remedial assistance with math, writing, and reading (Bahr, 2010b, forthcoming b; Bailey, Jeong, and Cho, 2010; Bettinger and Long, 2005; Deil-Amen and Rosenbaum, 2002; Goldrick-Rab, 2010; Grubb, 2010; Grubb and Cox, 2005; Hagedorn, 2010; Melguizo, Hagedorn, and Cypers, 2008; Perin, 2006; Perry, Bahr, Rosin, and Woodward, 2010). Of the three subjects, remedial mathematics is an especially challenging problem (Bahr, 2007, 2008, 2010c). On one hand, the body of evidence indicates that more students require assistance with math than with any other subject. On the other hand, math is the subject in which students are least likely to advance successfully to college-level competency. Hence, remedial math is a large and pressing issue for community colleges.

As an initial exploratory step, one might examine how participation in mathematics varies across the six clusters identified here. In Table 3.2, I present the distribution within each cluster of students' first nonvocational math course, if any. One may observe that 40 percent of all first-time students enrolled in a first nonvocational math course that was remedial in nature. Participation in remedial math was fairly low among students in the drop-in and noncredit clusters. However, 81 percent of students in the transfer cluster enrolled in a first math course that was remedial in nature, as did 66 percent of students in the exploratory cluster, 45 percent of students in the terminal vocational cluster, and 34 percent of students in the experimental cluster.

Importantly, although only about one-third of students in the experimental cluster participated in remedial math, this cluster of students is the second largest of the six (28 percent of all first-time students). In fact, it is twice as large as the transfer cluster. It follows that students in the experimental cluster constitute a sizable fraction of all remedial math students.

To examine this issue, I present in Table 3.3 the distribution of cluster membership by the skill level of a student's first nonvocational math course, if any. One may observe in Table 3.3 that students in the transfer, exploratory, and experimental clusters comprise the lion's share (90 percent) of all remedial math students. Students in the experimental cluster in particular comprise 24 percent of all remedial math students.

The experimental cluster describes students who exhibit a unique behavioral signature. As I explained, "These students appear to have 'tested the waters' of college and found those waters less than agreeable" (Bahr, 2010a, p. 733). On average, they enrolled in a near-half-time course load but succeeded in their courses only one-quarter (26 percent) of the time and remained in college for just two semesters on average.

Table 3.2. Frequency Distribution of First Nonvocational Math Course for Each of the Six Clusters of First-Time Students and for All First-Time Students

	Student Cluster						
	Drop-In	*Experimental*	*Noncredit*	*Terminal Vocational*	*Transfer*	*Exploratory*	*All Students*
College math	1%	3%	2%	4%	18%	19%	8%
	(561)	(1,102)	(46)	(186)	(3,650)	(6,720)	(12,265)
Remedial math							
Interm alg or geom	1%	5%	2%	7%	21%	17%	9%
	(413)	(1,895)	(48)	(293)	(4,404)	(6,017)	(13,070)
Beginning algebra	2%	10%	4%	16%	30%	23%	14%
	(925)	(4,243)	(88)	(679)	(6,092)	(8,081)	(20,108)
Prealgebra	2%	8%	4%	9%	17%	13%	8%
	(771)	(3,194)	(70)	(375)	(3,444)	(4,329)	(12,183)
Arithmetic	3%	12%	9%	12%	14%	13%	10%
	(1,572)	(4,808)	(170)	(515)	(2,808)	(4,523)	(14,396)
Only voc math	1%	1%	1%	7%	<1%	1%	1%
	(396)	(530)	(26)	(302)	(30)	(395)	(1,679)
No math attempted	90%	62%	77%	44%	1%	13%	50%
	(40,338)	(25,841)	(1,529)	(1,815)	(210)	(4,512)	(74,245)
Total	100%	100%	100%	100%	100%	100%	100%
	(44,976)	(41,613)	(1,977)	(4,165)	(20,638)	(34,577)	(147,946)

Note: Cell sizes provided in parentheses.

Table 3.3. Frequency Distributions of Cluster Membership by the Skill Level of a Student's First Nonvocational Math Course

	Student Cluster						
	Drop-In	*Experimental*	*Noncredit*	*Terminal Vocational*	*Transfer*	*Exploratory*	*Total*
College math	5%	9%	Less than 1%	2%	30%	55%	100%
	(561)	(1,102)	(46)	(186)	(3,650)	(6,720)	(12,265)
All levels of remedial math	6%	24%	1%	3%	28%	38%	100%
	(3,681)	(14,140)	(376)	(1,862)	(16,748)	(22,950)	(59,757)
Only vocational math	24%	32%	2%	18%	2%	24%	100%
	(396)	(530)	(26)	(302)	(30)	(395)	(1,679)
No math attempted	54%	35%	2%	2%	Less than 1%	6%	100%
	(40,338)	(25,841)	(1,529)	(1,815)	(210)	(4,512)	(74,245)
All students	30%	28%	1%	3%	14%	23%	100%
	(44,976)	(41,613)	(1,977)	(4,165)	(20,638)	(34,577)	(147,946)

Note: Cell sizes provided in parentheses.

Given this behavioral signature, one would expect that students in the experimental cluster would exhibit a low rate of success in math courses just as they do in their courses as a whole. In Table 3.4, I examine the distribution of the highest-skill math course completed successfully by the remedial math students within each cluster. As expected, fully 72 percent of remedial math students in the experimental cluster did not complete successfully any math courses, compared with 6 percent of remedial math students in the transfer cluster and 23 percent of remedial math students in the exploratory cluster. At the other end of the spectrum, less than 1 percent of remedial math students in the experimental cluster completed a college-level math course successfully, compared with 57 percent of remedial math students in the transfer cluster and 27 percent of remedial math students in the exploratory cluster.

Returning to the larger problem of remedial math in community colleges, the low rate of attainment of college-level skill among remedial math students has led to questions about the utility and effectiveness of remedial math in its existing form (Bailey, 2009; Perin, 2005). Yet, although the rate of attainment was not impressive in its magnitude, it was much higher among students in the transfer and exploratory clusters than it was among those in the experimental cluster. In fact, the combined rate of attainment of college-level math skill among remedial math students in the transfer and exploratory clusters (39.83 percent) was nearly one hundred times that of students in the experimental cluster (0.42 percent).

Given these stark differences, one might ask whether it is sensible to include experimental students when assessing the success of remedial math programs. Clearly remedial math students, like college students generally, are not an undifferentiated mass (Grubb, 2010). It happens, however, that students who performed poorly in all of their courses and departed early from the community college system (students in the experimental cluster) were concentrated in remedial math, which ultimately skews the calculated rate of attainment of college-level skill among students who participated in remedial math. In other words, the low rate of college-level skill attainment in math is in part a function of the high rate of participation by experimental students rather than a failure of remedial math itself.

Furthermore, one might ask if it is reasonable to include drop-in students in the assessment of remedial math. Although these students represent just 6 percent of all first-time remedial math students and although they exhibit a high rate of course success, they demonstrate by their behavior that they are using the community college system only for the purpose of taking a few classes. That is, they do not demonstrate intent to complete the remedial math sequence, and I find a correspondingly low rate of attainment of college-level math skill (3 percent).

Thus, instead of treating remedial math students as a block when measuring the success of remedial math programs and instruction, perhaps the more accurate approach is to differentiate students who

Table 3.4. Frequency Distributions of Highest-Skill Math Course Completed Successfully by Students Whose First Nonvocational Math Course Was Remedial in Nature

	Student Cluster						
	Drop-In	*Experimental*	*Noncredit*	*Terminal Vocational*	*Transfer*	*Exploratory*	*All Students*
College math	3%	Less than 1%	22%	12%	57%	27%	27%
	(109)	(60)	(83)	(225)	(9,562)	(6,250)	(16,289)
Remedial math							
Interm alg or geom	11%	4%	11%	14%	15%	14%	12%
	(411)	(511)	(42)	(261)	(2,582)	(3,217)	(7,024)
Beginning algebra	21%	8%	19%	27%	15%	18%	15%
	(769)	(1,120)	(70)	(499)	(2,430)	(4,229)	(9,117)
Prealgebra	15%	7%	10%	8%	5%	9%	8%
	(536)	(1,036)	(39)	(149)	(760)	(2,114)	(4,634)
Arithmetic	27%	9%	19%	10%	2%	7%	8%
	(985)	(1,251)	(71)	(190)	(348)	(1,714)	(4,559)
Only voc math	Less than 1%	Less than 1%	1%	3%	Less than 1%	1%	Less than 1%
	(9)	(39)	(3)	(53)	(52)	(125)	(281)
None	23%	72%	18%	26%	6%	23%	30%
	(862)	(10,123)	(68)	(485)	(1,014)	(5,301)	(17,853)
Total	100%	100%	100%	100%	100%	100%	100%
	(3, 681)	(14,140)	(376)	(1,862)	(16,748)	(22,950)	(59,757)

Note: Cell sizes provided in parentheses.

demonstrate intent to complete the math sequence from students who do not demonstrate this intent. Such differentiation is not uncommon in the calculation of institutional performance indicators for community colleges, albeit primarily as it pertains to institutional rates of upward transfer to four-year institutions (Bahr, Hom, and Perry, 2005; Hom, 2009; Horn and Lew, 2007; Sylvia, Song, and Waters, 2010; Townsend, 2002). In that regard, this classification scheme suggests that, at a minimum, differentiation should account for the number of courses that students attempted during their time in the system (differentiating drop-in students) and students' overall rate of success in those courses (differentiating experimental students).

Conclusion

Students use the community college in a wide variety of ways to achieve an equally wide variety of ends. Some of these ends align closely with institutional goals, priorities, and performance indicators, and others do not. Consequently a typology of community college students based on their use of the institution has the potential to be of great informational and interpretive value to community college stakeholders. In this chapter, I broadened and extended prior work on such a behavioral classification scheme. I then demonstrated how a typology of this sort may be used to understand and interpret policy- and practice-relevant data.

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