

Does College Focus Matter? Explaining Differences in Labor Market Outcomes among Community Colleges

Michael Dunn (Corresponding author)

Department of Sociology, University of North Carolina at Chapel Hill

155 Hamilton Hall CB 3210, Chapel Hill, NC 27599, USA

Tel: 1-(206)-399-3359 E-mail: mikewill@live.unc.edu

Arne L. Kalleberg

Department of Sociology, University of North Carolina at Chapel Hill

155 Hamilton Hall CB 3210, Chapel Hill, NC 27599, USA

E-mail: arne_kalleberg@unc.edu

Received: April 20, 2016 Accepted: May 24, 2017 Published: May 31, 2017

doi:10.5296/jei.v3i1.11093 URL: <https://doi.org/10.5296/jei.v3i1.11093>

Abstract

The evolution of community colleges from their origins as junior colleges to institutions with dual missions to provide both academic and workforce preparation raises questions about the impact of a college's mission focus on their students' labor market success. We examine this question using the 58 colleges in the North Carolina Community College system as case study for community colleges nationally. We find that students from community colleges that specialize or focus on career objectives had higher labor market earnings; about one-fifth of the variation in students' earnings across community colleges is due to the college's mission focus. Other community college variables also enhance students' earnings, such as institution size as well as having single-county service areas and low proportions of remedial students.

Keywords: Community colleges, Labor market outcomes, Earnings, Comprehensive, Vocational, Academic

1. Introduction

Community colleges play a significant role in the US system of higher education. They are

numerically significant, enrolling about 50% of all first-time college students in the U.S. (Cohen & Brawer, 2008) and 43% of all undergraduates (American Association of Community Colleges, 2015). They also have a significant presence in local communities, as over 95% of the nation's population live within commuting distance of a community college, and they represent 75% of the foreign language offerings in higher education (Cohen & Brawer, 2008). Moreover, their affordability increases access to higher education: in 2011-2012 the average tuition (fees, room and board not included) was \$28,500 at private colleges; \$8,244 for state residents at public colleges; and \$2,085 for community colleges (American Association of Community Colleges).

The North Carolina Community College System, like the national system, plays a significant role in higher education in North Carolina. It is the third largest system nationally with 58 colleges statewide (California, with 117 colleges, and Texas, with 64 broken out in 5 different systems, are first and second respectively). Every resident of North Carolina lives within 30 miles of a community college, and with 840,000 enrollments in 2010-11, one in nine residents are currently enrolled in their local community college (NCCCS, n.d.). The colleges offer a collective total of more than 1,000 curriculum programs (at the certificate, diploma and the associate degree levels) under more than two hundred fifty curriculum titles (NCCCS, 2008b).

Community colleges today are much different than in the early years. While initially seen as institutions for academic preparation, the current iteration of community colleges is more often characterized by being *comprehensive*, as *both* a principal provider of academic instruction and a major supplier of vocational preparation and workforce development (Kasper, 2002). Comprehensive community colleges are a crucial bridge to both higher education as well as the labor force and seek to achieve multiple goals as they serve an array of different stakeholders with a diverse set of expectations and demands. Nevertheless, the comprehensive role of the community college system could hinder student performance. For example, some community colleges may be better able to (or purposely to try to) achieve *either* academic *or* workforce preparation, but not both. By trying to accomplish both goals, these more comprehensive colleges may instead hurt their students' performance with regard to both academic and workforce preparation.

In this paper, we examine whether students attending career-focused community colleges have better labor market outcomes compared to students attending comprehensive or academic-focused community colleges. Understanding the performance of comprehensive as opposed to more specialized community colleges is important, as this affects decisions about how colleges should be evaluated, how resources should be allocated, and potentially how prospective students select which community college to attend. Using data from the North Carolina Community Colleges, we analyze the factors associated with higher earnings. We first provide a brief overview of the evolution of community colleges nationally as well as in North Carolina, and then review previous research on the efficacy and desirability of comprehensive as opposed to specialized community colleges. We then describe our data and present our results. We finally summarize our conclusions and their implications for understanding the performance of community college students.

2. Comprehensive vs Career or Academic Focused?

Research on community colleges is divided on the efficacy of the comprehensive community college. Bailey and Averianova (1999) summarize the prevailing arguments that the “multiple missions” of comprehensive colleges benefit students. First, many students enter college without a clear vision of their future and comprehensive community colleges enable them to explore many different options. Second, comprehensive community colleges have stronger mechanisms for recruitment and building demand when they have a diverse set up programs to first reach students; having many ways for students to interact might increase the likelihood of those students enrolling in other programs. Lastly, colleges develop relationships with local businesses through customized training or other activities; these relationships may also be useful for the academic programs by providing support, assistance, internships and job placement for the academic programs.

Others have pointed out the disadvantages of comprehensive community colleges. Breneman and Nelson (1980) argued that the fiscal burden of such comprehensive offerings means that community colleges should narrow their focus. Cross (1985, p. 35) summarized this view by asking rhetorically, “Can any college perform all of those functions with excellence—or even adequately in today’s climate of scarce resources and heavy competition for students?” Others have argued that community colleges cannot serve career-oriented students when their organizational structures mimic academically focused institutions (Baker, 1999).

Some sociologists have maintained that the structure of the community college and the conflicting objectives of academic and vocational education not only accentuate inequality but enforce class differences (*e.g.* Brint & Karabel, 1989; Clark, 1960a; Clark, 1980; Dougherty, 1994). Clark (1960a) contended that the community college system, in essence, was there to filter out (or “cool out”) “uncompromising students” with low academic potential and future prospects that do not have the intellectual, social and economic capital necessary to succeed there. His case study of San Jose Junior College pointedly suggested that while the junior college is beholden to public schools, state agencies and universities, its organizational character is largely shaped by its community and students; officials want an organization whose main focus is vocational training, while students often want an organization that will facilitate their transfer to a 4-year university (Clark, 1960b).

Among scholars advocating for community college specialization, there is certainly no consensus on whether the colleges should focus on academic or vocational training. Supporters of the academic mission focus argue that a vocational emphasis draws students into vocational training and thereby weakens academic transfer opportunities (Dougherty, 1994). Brint and Karabel (1989) argue that a vocational function has shifted the entire mission of community colleges towards serving as training schools for low and middle class occupations, thus limiting students’ opportunities for transfer and academic advancement. Others have objected to the comprehensive model because it detracts from what they believe should be the core function of community colleges—vocational education and workforce preparation (Blocker, Plummer, & Richardson, 1965; Grubb, 1996). Clowes and Levine (1989) claim that workforce preparation is the only viable core function for most community

colleges, while Leitzel and Clowes (1991) considered vocational training to be the most important role of community colleges within the system of higher education. According to Grubb (1996, p. 83), “One implication for community colleges is that they need to take their broadly defined occupational purposes more seriously ... They are not academic institutions ... even when many of their students hope to transfer to four-year colleges.”

Some researchers have sought to study empirically the efficacy of the comprehensive model for student outcomes. Using state-level data, Grubb (1989) found that the vocational focus of community college systems hindered bachelor’s degree attainment by obstructing transfer. Although not systematically tested, scholars argue these results suggest that students attending those institutions may be discouraged from transfer and lack the institutional support needed for successful transfer (Brint & Karabel, 1989; Dougherty, 2001). Several studies have also shown that colleges with higher proportions of liberal arts courses have higher transfer rates (Armstrong & Mellissinos, 1994; Cohen & Ignash, 1994). Dougherty (2002) further proposed that a vocational focus increases the influence of local businesses on community colleges, which may negatively affect transfer programs by decreasing the value of general education and the resources available to construct and maintain effective articulation agreements (see also Dougherty & Bakia, 2000; Gumport, 2003). Still others have argued that because of the limited transferability of vocational courses to four-year institutions, comprehensive community colleges with large vocational foci are putting students in those programs at a considerable disadvantage (Palmer, 1999; Schuyler, 1999).

More recently, Roska (2006) examined whether the vocational focus of community college harms their students’ educational attainment as measured by completion of associate degrees, transfers to four-year institutions and bachelor degree attainment. After controlling for individual and state characteristics, she found that community colleges offering vocational training in degree-granting programs did not hinder students’ educational attainment, but that colleges with a greater focus on short-term offerings such as certificates did.

While research on the economic returns to community college schooling is relatively robust, empirical evidence on the relative advantages for students of community colleges emphasizing either academic or workplace preparation—or the desirability of doing both—is conspicuously scarce. Scholars have yet to examine if labor market outcomes differ between specialized and comprehensive community colleges. Moreover, while a number of studies have used degree attainment (*e.g.* Calcagno et al., 2008; Roska, 2006) and/or transfer rates (*e.g.* Clotfelter et al., 2013; Dougherty, 2002; Jenkins, 2007) to measure efficacy, relatively few have assessed efficacy in terms of labor market outcomes of students (Mobley, 2001; Mobley, 2002; Kalleberg & Dunn, 2015).

We aim to fill some of these gaps by measuring differences among North Carolina Community College System according to whether their missions are comprehensive as opposed to career- or academic focused. We then use our measure of mission focus to assess its impacts on the earnings of community college students.

2.1 From Junior Colleges to Comprehensive Community Colleges

The national community college system had a humble beginning in 1901 with Joliet Junior College, an annex to Joliet High School in Chicago. Its mission was simple, “to prepare students for college by offering curricula similar to the first two years of college” (Eells, 1931). It was called Junior College simply because the creator, William Rainey Harper (then-president of the University of Chicago) thought it was an apt way to describe the work of the freshman and sophomore years at school. At the completion of the two years he would issue them a junior certificate, which became the precursor to what is now known as the associate degree. The early 20th century saw a growth in junior colleges as college presidents and other educational leaders recognized the value of junior colleges in the higher education system.

Junior colleges were also promoted as key *social* institutions to encourage “national cooperation, social cohesion, and social solidarity” (Department of the Interior, Bureau of Education, 1918). First-generation leaders of the junior college movement saw this as support of their growing position that these institutions should serve as sources of vocational training. While not evident at the time, an ideological contradiction was being born. The students saw and expected the junior college to serve as a mechanism for social mobility, yet the leaders of junior colleges saw them primarily as vehicles for vocational training (Frye, 1992).

Two prominent scholars fostered this emerging dual function of junior colleges, Leonard V. Koos at the University of Chicago and Walter Crosby Eells at Stanford. Koos (1926) introduced the idea that junior colleges could and should play a dual role of “rounding out” the education of high school students “who will not, cannot, or should not go on” to university and prepare these students to become “semi-professional” while simultaneously preparing other students for university. Eells, the editor of the *Junior College Journal* reiterated this argument in 1931.

The continued transformation to comprehensive community colleges was more a product of political and social demands than a concerted strategic decision. The 1944 Servicemen’s Readjustment Act, or the GI Bill, provided unemployment benefits, mortgage assistance and federal funding for tuition. By the time this arrangement ended in 1956, an estimated 2.2 million veterans had taken advantage of these tuition benefits. The Truman Commission Report (1947) was perhaps more important for the evolution of the national community college system, as it formally expanded the role of junior colleges as providing “technical education,” a type of education it defined as “social citizenship” training coupled with vocational training. The report also suggested a new name and institutional identity, a “community college.” This report legitimated a dual mission for community colleges, who were expected to offer open door access to large numbers of students from all backgrounds, serve the community in which they resided, while simultaneously offering services to students looking to transfer to a four-year university.

By the 1960s, agencies and governments were taking notice of lack of central planning regarding the locations, missions and curricula of community colleges. Formal policy initiatives began sprouting up at the state level to combat this. To this end, the Carnegie

Commission on Higher Education funded a policy study to examine the expansion of the community college system through the 1960s. The report made several recommendations (Carnegie Commission on Higher Education, 1970):

- 1) The systems should be connected to the local community.
- 2) The systems should be completely funded by government (local, state and federal).
- 3) An “open door” college should be available to all persons within commuting distance.
- 4) Community colleges should have comprehensive missions including “academic, occupational, and general education.”
- 5) Community colleges should only accept high school graduates or “otherwise qualified, individuals.”

Partly fueled by this report, the momentum around the community college system continued, and colleges began to adopt the re-institutionalized identity of a comprehensive community college. In 1962, the American Association of Collegiate Registrars and Admissions officers added further credibility to the community college identity by defining it in its *Handbook of Data and Definitions in Higher Education* as:

A two-year institution of higher education, generally public, offering instruction adapted in content, level, and schedule to the needs of the community in which it is located. Offerings usually include transfer curricula (credits transferable towards a bachelor’s degree), occupation (or terminal) curriculums, general education and adult education. (p. 10).

The last couple of decades of the 20th century and the first decade of the 21st century could be characterized periods of “steady states” for community colleges nationally, as institutions offering vocational, collegiate, developmental, and community education, with the associate degree as its highest award, had become well accepted by the public and by the state-level coordinating and funding agencies (Cohen & Brawer, 2008).

2.2 The Evolution of the North Carolina Community College System

North Carolina adopted junior colleges relatively late: the first, Buncombe County Junior College (also known as Biltmore College) started in 1927. A statewide community college system in North Carolina wasn’t established until 1952, when a study of the need for a system of tax-supported community colleges authorized by the North Carolina State Superintendent of Public Instruction was published. In 1957, the North Carolina State Legislature passed the Community College Act to support an “academically-oriented public community college system.” At the same time, yet separate from the Community College Act, the legislature also appropriated funds to initiate a statewide system of industrial education centers to meet the demand for workers by North Carolina industry. Both systems would be supervised by the North Carolina Board of Higher Education but would be managed by separate governance boards. By 1961, there were five public junior colleges emphasizing arts and sciences and seven industrial education centers focusing on technical and vocational education (NCCCS, 2008b). (A Matter of Facts: The North Carolina Community College

System Fact Book, 2008). While it may on the surface seem redundant to have two separate systems within a state focused on extending education beyond high school, such a strategy decoupled the competing missions facing community colleges.

That system remained in place until the mid-1960s, when Governor Terry Sanford sought to expand the missions of the North Carolina community colleges and industrial centers, arguing: "... the junior-college should be an institution which undertakes everything not being taken care of elsewhere ... such as education of the illiterates, uplifting of the underprivileged, retraining the unemployed – a truly comprehensive institution" (Lombardi, 1964). Along with the comprehensive mission he envisioned, he also felt that the current administrative structure of having two separate, state-funded systems, governed by two different boards within North Carolina was unwieldy. On July 1, 1963, the North Carolina General Assembly established the Department of Community Colleges under the State Board of Education. Of the five junior colleges that focused on arts and sciences, three were converted into four-year state colleges and two were brought under the Department of Community Colleges, which was also given control over 20 industrial education centers previously established. By the end of Governor Sanford's single term, there were 43 institutions with 28,250 full-time equivalent (FTE) enrollments (NCCCS, 2008b). (A Matter of Facts: The North Carolina Community College System Fact Book, 2008). The change in the statute also included a mandated comprehensive mission for the North Carolina Community College System, which brought the state in line with the national trend of comprehensive community colleges.

3. Data and Variables

We collected institutional information for each of the 58 North Carolina community colleges, from NCCCS data, from census and other government data, and from the websites of the 58 community colleges.

3.1 College Focus

Our measure of whether the mission focus of the college is comprehensive, as opposed to academic or career-oriented, is based on two features of the websites of these colleges: the college *mission statement* and its *website messaging*.

The college mission statement provides useful information denoting the general orientation of the college and has been argued to influence key community college decisions (see Bogart, 1994; Dougherty & Hong, 2006). Furthermore, college mission statements could reflect decision or actions already taken by the college. The following examples of community college mission statements illustrate how we coded the college's mission focus:

Career Focused Mission: "... [community college] is a statewide multi-campus community college committed to providing affordable, open admission, post-secondary education that is relevant and responsive to labor market and community needs."

Academic Focused Mission: "The mission of ... [community college] is to provide accessible, high quality learning experiences to meet the educational needs of the ...

community.”

Comprehensive or Non-specialized Mission: “... [community college] is a dynamic, diverse learning community that supports all students in their education, leading to a career, transfer to four-year institutions, and the pursuit of lifelong learning.”

A second indicator of a community college’s mission focus was its website messaging. We coded each headline on the homepage of each institution’s website as reflecting a *career* or *academic* mission. We coded colleges’ homepage headlines that denoted ambiguous missions as *comprehensive* or *non-specialized* (Note 1). The following are examples of community college homepage headlines that illustrate how we coded website messaging:

Career Focused:

Enhance your career: Over 50 programs to study

Earn a stackable credential – providing opportunities to go to work

New facilities and new programs – training students for higher paying jobs

More skills, better opportunities

Machining programs provide training for jobs with great wages

Quality programs for in-demand jobs

Academic Focused:

Your success is our goal – supporting students in their academic endeavors

Build your future not your debt: Four degrees designed for transfer

Success starts here! Earn a degree

College transfer programs – earn a diploma or degree

Students start here: Degrees, diplomas, or credit certificates including college transfer and general education

Comprehensive or Non-specialized:

One college. Many paths

Choose your perspective—we’ll help you get started: Degrees, transfers, and job training

Follow your passion – earn a degree, start your career

Something for everyone – over 100 programs of study

We then combined the information on a college's mission statement and website messaging to create three dichotomous variables denoting the mission focus of each community college, whether colleges had matching messaging and missions (career-career or academic-academic), and a variable for comprehensive colleges or colleges with mixed messaging and missions. We identified 46 institutions as non-specialized or comprehensive, five as academic, and seven as career-focused.

3.2 Institutional Level Characteristics

Research on the institutional sources of community college performance suggests factors that are likely to differentiate colleges (see the summary in Kalleberg & Dunn, 2015). We need to control for these institutional characteristics to determine whether other features of the institutional context can account for the association between the college's mission focus and students' earnings. We classified these institutional characteristics into six categories. We outline our rationale for why these might be related to labor market outcomes in this section. We also describe these measures and present their descriptive statistics in Table 1.

Table 1. Community college variables used in the analysis

Variable Name	Mean	Min	Max
<i>General Institutional Characteristics</i>			
Student enrollment in 2002-2003	9.30	7.5	10.95
Percent of full-time faculty	0.31	0.13	0.56
<i>Student Composition Characteristics</i>			
Percent of student body in remedial courses	0.20	0.03	0.49
Percent of students applying for financial aid	0.44	0.24	0.70
<i>Community College Service Area Characteristic</i>			
Single county service area —if a community colleges service area is a single county, 1 = yes	0.52	0	1
UNC campus in area	0.10	0	1
<i>Labor Market Characteristics of Community College Service Area</i>			
“Urbanness” —Measured using federal population density data	0.48	0.09	0.99
Service area unemployment rate, 2008-2010 —Created an ordinal variable that represented colleges 2 percent or greater “below the state average”, within 2 percent in either direction of the state “average”, and greater than 2 percent “above the state average”	2.15	1	3
<i>Institutional Labor Market Focus</i>			
Rate of student transfer, 2002-2003 cohort	0.34	0.22	0.61
Proportion of “applied” offerings in curricula programs	0.58	0.4	0.77
Proportion of FTE enrollments in continuing education offerings (ceratio)	0.68	0.53	0.81
Proportion of instructional budget allocated to continuing education (cebudget)	0.33	0.12	0.80
<i>Internal Management</i>			
Career mission and career messaging	n = 7	0.00	1.00
Academic mission and academic messaging	n = 5	0.00	1.00
Comprehensive or mixed mission and messaging	n = 46	0.00	1.00

We build on research by Kalleberg and Dunn (2015) that analyzed the effects of institutional characteristics of community colleges on the labor market earnings in North Carolina. We note that our institutional variables from that study explain relatively little of the variation in

earnings, after controlling for characteristics of individuals (about 1 percent for men and about 0.7 percent for women); the vast bulk of the variation of earnings lies within, rather than between, colleges. More specifically, students' individual characteristics with community colleges were accounted for the majority of the variation in graduate earnings. On the other hand, these institutional variables are fairly successful in accounting for the variation in wages among the 58 community colleges, explaining 52 percent (men) and 60 percent (women) of the total variation in earnings between community colleges.

General institutional characteristics. We looked at two aspects of organizational size: student enrollment in 2002-03 (NCCCS, 2003a) and percentage of full-time faculty. Most studies that assess the impact of institutional-level variables on educational outcomes include this measure of organization size, though previous findings about its direction and significance are mixed. Kuo (1999) found a positive relationship between size (student enrollment) and student academic success and argued that economies of scale allow larger institutions to offer more programs and degrees than smaller institutions, resulting in better graduation rates. Mobley (2001, p. 19) also found a positive relationship between wages in the labor market and student enrollment, and concluded that economies of scale allow larger institutions to invest in and develop occupational training programs that prepare students for available work and higher paying occupations. By contrast, other studies have found a negative relationship between enrollment and measures of community college efficacy (*e.g.*, Calcagno et al., 2008; Huffman & Schneiderman, 1997). Still other studies have found no correlation between enrollment and student outcomes (*e.g.*, Antley, 1999; Clotfelter et al., 2013).

Studies have also examined the effect on performance of the proportion of full-time faculty (NCCCS, 2002, 2003b, 2004, 2005, 2006, 2007, 2008a, 2009, 2010, 2011, 2012a) and the student-faculty ratio. Some researchers maintain that a lower proportion of full-time faculty members does not lead to lower graduation rates (Ehrenberg & Zhang, 2005), but most research indicates that increases in part-time faculty negatively affect student outcomes. Jacoby (2006) found a significant negative effect on graduation rates as the proportion of part-time faculty increased. Some have argued that part-time faculty are less certain about their place in the institution, are often viewed as less prepared to teach, are less committed to the institution, and are less available to students; these are among the factors that are likely to lead to lower student academic persistence and success (Benjamin, 2002; Cottingham, Newman, & Sims, 1981; Eagan & Jaeger, 2009; Goble, Rosenbaum, & Stephan, 2008; Griffith & Connor, 1994; McGuire, 1993).

Student body composition characteristics. These variables are specific to the composition of the student body of the community college, and we obtained them by aggregating individual-level data on students within each college. The consensus of most literature is that colleges with a low proportion of remedial students will have higher performing high school students and thus will have better education outcomes (*e.g.*, Lee, 2012). Several studies have also shown that degree attainment is positively related to institutional selectivity (Marcus, 1989; Saupe, Smith, & Xin, 1999; Sjoberg, 1999). Thus, we would expect to find lower wages and lower academic performance in community colleges that have higher proportions of students entering college as remedial students. The second variable, the proportion of

students who applied for financial aid, assumes that those applying for financial aid will be lower income students. At the individual level research is divided.

Scholars have shown that higher income students tend to have more educational success (Toutkoushian & Smart, 2001), which suggests that a community college with a higher proportion of students applying for financial aid will be associated with lower outcomes overall. Other research, though, has shown that student motivation strongly correlates with higher student outcomes (*e.g.*, Church, Elliott, & Gable, 2001; Pintrich & Schunk, 1996).

Community college service area characteristics. Some community college service areas span multiple counties, and some community colleges are asked to serve only one county. We hypothesize that community colleges that serve a single county may be better able to focus their efforts on preparing their students for the job opportunities that are available in the geographical area, which is likely to result in students getting better jobs and higher wages (Notes 2 and 3). The second variable is whether there is a University of North Carolina (UNC) four-year college campus in the community college service area (Note 4). One viewpoint is that community colleges that share a service area with a UNC campus will have a greater proportion of students intending to transfer to that campus and so are likely to have stronger and clearer pathways and agreements for transferring to that specific four-year college; this ought to lead to higher wages. On the other hand, a greater institutional focus on the needs of transfer students might result in lower wages, as these community colleges may be disproportionately preparing students to transfer rather than to enter the labor market.

Labor market characteristics of community college service area. We measure the degree of urbanization of a community college service area to better understand the relationship with wages (Note 5). Although community colleges in urban service areas may have students with higher wages because they have greater job opportunities, urban areas are also likely to be associated with more job applicants, which might depress wages.

The unemployment rate is an essential variable to consider, given the strong theoretical relationship between overall wages in a specific area and the strength and stability of the local labor market, as measured by number of jobs and job opportunities. We measure the average unemployment rate in the service area during the period from 2008 to 2010 (Note 6).

Institutional labor market focus. These variables measure the extent to which the community college's offerings are focused on providing students with skills that match the job opportunities in the local labor market. We first use two institution-level measures of offerings to students: the proportion of FTE enrollments in continuing education offerings (Note 7) and the proportion of "applied" offerings in the curriculum programs at the community college (Note 8). Together, these variables demonstrate the opportunities students have to receive training and credentials that will prepare them for opportunities in their local labor market.

We also include a measure of the rate of student transfers to four-year colleges (NCCCS, 2003a). While the transfer rate has often been studied as an indicator of the efficacy of community colleges, others have used it as a proxy for the vocational emphasis of the

community college. Mobley (2001), for example, assumed that community colleges with a higher proportion of transfer students will allocate more resources to those students and fewer resources to labor market focused programs.

Finally, we use an indicator of the proportion of the instructional budget that is allocated to continuing education in 2002-03 (Briggs, 2002) to reflect the community college's labor market focus from a fiscal and resource standpoint (cf., Calcagno et al., 2008; Clotfelter et al., 2013). We use this measure rather than the total budget because the NCCCS's funding model is based heavily on enrollment (the correlation between student enrollment and total budget is almost .94 in these data), and so a pure expenditure or budget variable is too collinear with enrollment.

3.3 Community College Performance

We operationalize the performance of the community college by a measure of their students' labor market earnings, using (the log of) 2011 quarterly earnings data. These data are comprised of all first-time-in-college students in designated curriculum programs leading to awards who began in the NCCCS in the academic years 2001-02 through 2009-10. The combined student dataset was then merged with North Carolina Department of Commerce Unemployment Insurance (UI) records using social security numbers. The UI data include earnings collected on a quarterly basis from UI-covered employers and include total earnings from all jobs, as well as Standard Industrial Classification (SIC) and North American Industry Classification System (NAICS) information for each job (there is no information on hours of work or occupation). Our primary focus here is on the 2002-03 NCCCS entry cohort, for which we have nine years of NCCCS and National Student Clearinghouse (NSC) transcript data; we also have earnings data for the period from the first quarter of 1996 (*i.e.*, before any of the students in our sample enrolled in college) to the first quarter of 2012. All earnings are adjusted for inflation and expressed in 2010 dollars based on the quarterly Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W). This dataset yields over 5 million quarters of earnings data across 830,000 students (Note 9).

3.4 Career Focused Community Colleges: A Closer Look

Table 2 summarizes how our institutional characteristics are similar or different in the three types of college missions (comprehensive, career- and academic-oriented). The results are based on a multinomial logistic regression between college focus and the other institutional characteristics. The results confirmed our suspicion that community colleges with specific foci (career or academic) do not differ much in their general institutional characteristics (size and faculty composition), the unemployment rate in the service area, and transfer rates and performance. The relative lack of differences in institutional characteristics among community colleges that differ in their mission focus is not surprising, given that almost 80% of them are labeled as comprehensive.

Table 2. Multinomial logistic regression results

	Coefficient	S/E
<i>1) Academic-Focused Colleges</i>		
Student enrollment in 2002-2003 (log)	-1.890	2.034
Percent of full-time faculty	1.769	9.094
Proportion of student body entering to finish high school	-4.554	8.600
Percent of student body applying for financial aid	-9.692	9.053
Single county service area	-1.954	1.639
UNC campus in service area	0.892	1.947
Rural or urban service area	1.651	4.917
Service area unemployment rate, 2008-2010	1.834	1.538
Rate of student transfer, 2002-2003 cohort	0.572	14.620
Proportion of “applied” offerings in curricula programs	2.563	8.479
Proportion of FTE enrollment in CE offerings	6.199	14.189
Proportion of instructional budget allocated to CE	1.776	3.392
Constant	7.495	20.808
<i>2) Comprehensive or Non-Specialized Colleges</i>		
	(base outcome)	
<i>3) Career-Focused Colleges</i>		
Student enrollment in 2002-2003 (log)	-0.884	1.633
Percent of full-time faculty	11.227	9.533
Proportion of student body entering to finish high school	-13.351	10.194
Percent of student body applying for financial aid	-10.049	9.753
Single county service area	-0.504	1.129
UNC campus in service area	-15.769	29.140
Rural or urban service area	3.828	5.085
Service area unemployment rate, 2008-2010	-0.196	1.261
Rate of student transfer, 2002-2003 cohort	-1.369	11.025
Proportion of “applied” offerings in curricula programs	14.710	9.498
Proportion of FTE enrollment in CE offerings	-3.929	10.223
Proportion of instructional budget allocated to CE	0.580	3.082
Constant	0.753	20.156

4. Results

Table 3 presents the results of our estimations of the effects of college mission focus on earnings, before (Model 1) and after controlling (Model 2) for the other institutional characteristics. Students from community colleges whose missions focused specifically on careers and workforce preparation had higher earnings than students from either comprehensive colleges or community colleges with an academic focus. Moreover, the college's mission focus was responsible for about one-fifth (R^2 for Model 1 = .2069) of the between-community college variation in labor market outcomes.

Table 3. Regression results

Variable	Model 1 College Focus Only		Model 2 Focus + Institutional Characteristics	
	Coefficient	S/E	Coefficient	S/E
<i>College Focus</i>				
Career mission and career messaging	0.117***	0.033	0.056*	0.024
Academic mission and academic messaging	-0.062	0.038	-0.031	0.027
Comprehensive or mixed mission and messaging	0	omitted	0	omitted
<i>General Institutional Characteristics</i>				
Student enrollment in 2002-2003 (log)			0.081***	0.021
Percent of full-time faculty			-0.103	0.107
<i>Student Composition Characteristics</i>				
Proportion of student body entering to finish high school			-0.407***	0.093
Percent of student body applying for financial aid			-0.133	0.996
<i>Community College Service Area Characteristics</i>				
Single county service area			0.042*	0.017
UNC campus in service area			-0.016	0.026
<i>Labor Market Characteristics of Community College Service Area</i>				
Rural or urban service area			-0.113	0.057
Service area unemployment rate, 2008-2010			0.003	0.016
<i>Institutional Labor Market Focus</i>				
Rate of student transfer, 2002-2003 cohort			0.032	0.116
Proportion of “applied” offerings in curricula programs			0.104	0.107
Proportion of FTE enrollment in CE offerings			-0.257	0.153
Proportion of instructional budget allocated to CE			0.022	0.045
Constant	8.72***	0.012	8.02***	0.258
r-Squared	0.2069		0.7477	

Note. Dependent variable is logearnings; * $p < .05$; ** $p < .01$, *** $p < .001$.

Comparing the coefficients for career focus in Models 1 and 2 suggests further that about half of the effect of college focus (.117 → .056) is explained by the other institutional variables in the model. In particular, we find that (log) enrollment size is positively associated with earnings; students whose community colleges have single-county service areas earned more; and students who attend colleges whose students performed better at transfer institutions earn more. Also, students who attended community colleges that had higher proportions of remedial students earned less.

5. Discussion and Conclusion

Community colleges in North Carolina, like in many other states, are important drivers of social as well as economic outcomes; indeed, it is difficult to overstate the connection of community colleges to the labor market. As demonstrated, the evolution to the current comprehensive community model from the junior college model was largely driven by social and political ideology rather than sound financial or administrative decision making and this could have repercussion on the economic health of the communities they serve. In North Carolina, for example, some have suggested that one third of the increase in unemployment has been due to a skills mismatch in the labor market (Walden, 2014). In other words, many North Carolina workers are unemployed because they do not possess the skills for which employers are hiring. Community colleges have historically played a key role in retraining and preparing workers for new careers and a career-focused community college may be better equipped to meet this goal. Furthermore, scholars have predicted that by 2020 in North Carolina, there will be fewer low-skill, middle-wage jobs and that many of the “new middle” jobs will demand higher skills requiring a post-high school technical education (Jolley, 2013), which many workers are currently lacking. We found that some community colleges were better able (or purposely try) to achieve a workforce preparation focus that resulted in superior labor market outcomes for their students. Colleges that seek to accomplish both goals may instead hurt their students’ performance with regard to workforce preparation. These effects of college focus on community college performance were over and above the impacts of institutional characteristics, some of which are significantly related to performance as well.

Our finding that college focus, specifically whether it is career-focused, can affect a student’s labor market outcomes is suggestive, but should be evaluated in light of the limitations of this measure. In particular, while colleges’ mission statements and website messaging may be indicative of their focus (especially as this is understood by prospective students), they may also be poorly written (especially if they are written by a committee) and reflect public relations and other considerations that are not well grounded in what the college actually does. Future research needs to develop more objective measures of college focus will allow for more precise estimation of its causes and consequences.

In addition, the data we used here are limited to college credit offerings and curriculum programs. Research on the correlates of colleges’ foci needs to include information on student who take non-credit continuing education offerings and pursue certification programs. This is especially salient when considering the impacts of career-focused colleges, for whom

certificate programs are central elements. A more complete picture of the effects of specialization on student outcomes also requires an assessment of the extent to which students from colleges that focus on academic outcomes fare with regard to future academic success, compared to career-focused and comprehensive community colleges.

Our findings have implications for college administrators and key stakeholders nationally who are tasked with deciding if a college should pursue a more comprehensive agenda or a specialized focus. While previous research (e.g., Kalleberg and Dunn 2015) has shown contextual factors outside of the control of the college's administration but with which a community college must contend—such as population density and unemployment rate—negatively affect labor market outcomes, this analysis suggests that a college's mission focus—which *is* subject to the control of college administrators—also affects earnings. Our findings also have implications for policymakers who are grappling with how the higher education system can meet the needs of the citizens, communities and businesses in the future, and we believe, a thoughtful and proactive approach to the role of community colleges is vital.

Acknowledgements

The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305C110011 to Teachers College, Columbia University. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education. We thank Thomas Bailey, Clive Belfield, and Davis Jenkins for their helpful comments on earlier versions.

References

- American Association of Collegiate Registrars and Admissions Officers. (1962). *Handbook of data and definitions in higher education*. Washington, DC: Authors.
- American Association of Community Colleges. (2015). *2015 fact sheet*. Washington, DC: Author.
- Antley, H. W. (1999). *The development of a predictive model for one-year freshman retention rate: A macro-approach*. Paper presented at the 39th annual forum of the Association for Institutional Research, Seattle, WA.
- Armstrong, W. B., & Mellissinos, M. (1994). Examining the relationship between the liberal arts, course levels, and transfer rates. *New Directions for Community Colleges, 1994(86)*, 81-91. <https://doi.org/10.1002/cc.36819948610>
- Bailey, T., & Averianova, I. (1999). *Multiple missions of community colleges: Conflicting or complementary* (CCRC Brief No. 1). New York, NY: Columbia University, Teachers College, Community College Research Center.
- Baker, G. A., III. (1999). Building the comprehensive community college. *Community College Journal, 69*, 32-39.

- Benjamin, E. (2002). How over-reliance upon contingent appointments diminishes faculty involvement in student learning. *Peer Review*, 5(1), 4-10.
- Blocker, C. E., Plummer, W., & Richardson, R. C. (1965). *The two-year college: A social synthesis*. Englewood Cliffs, NJ: Prentice-Hall.
- Bogart, Q. (1994). The community college mission. In G. Baker (Ed.), *A handbook on the community college in America* (pp. 60-73). Westport, CT: Greenwood Press.
- Breneman, D. W., & Nelson, S. C. (1980). The community college mission and patterns of funding. *New Directions for Community Colleges*, 1980(32), 73-81. <https://doi.org/10.1002/cc.36819803208>
- Briggs, K. D. (November 18, 2002). *Summary of college budget request—2002-03* (Memo No. CC02-228) [Memo to Chief Business Officers]. Raleigh, NC: North Carolina Community College System.
- Brint, S., & Karabel, J. (1989). *The diverted dream: Community colleges and the promise of educational opportunity, 1900-1985*. New York, NY: Oxford University Press.
- Calcagno, J. C., Bailey, T., Jenkins, D., Kienzl, G., & Leinbach, T. (2008). Community college student success: What institutional characteristics make a difference? *Economics of Education Review*, 27(6), 632-645. <https://doi.org/10.1016/j.econedurev.2007.07.003>
- Carnegie Commission on Higher Education. (1970). *The open-door colleges: Policies for community colleges*. New York, NY: McGraw Hill.
- Church, M. A., Elliot, A. J., & Gable, S. L. (2001). Perceptions of classroom environment, achievement goals, and achievement outcomes. *Journal of Educational Psychology*, 93(1), 43-54. <https://doi.org/10.1037/0022-0663.93.1.43>
- Clark, B. R. (1960a). The “cooling out” function in higher education. *The American Journal of Sociology*, 65(6), 569-576. <https://doi.org/10.1086/222787>
- Clark, B. R. (1960b). *The open door college: A case study*. New York, NY: McGraw-Hill.
- Clark, B. R. (1980). The “cooling out” function revisited. *New Directions for Community Colleges*, 1980(32), 15-31. <https://doi.org/10.1002/cc.36819803204>
- Clotfelter, C. T., Ladd, H. F., Muschkin, C. G., & Vigdor, J. L. (2013). Success in community college: Do institutions differ? *Research in Higher Education*, 54(7), 805-824. <https://doi.org/10.1007/s11162-013-9295-6>
- Clowes, D. A., & Levin, B. H. (1989). Community, technical, and junior colleges: Are they leaving higher education? *Journal of Higher Education*, 60, 349-356. <https://doi.org/10.2307/1982254>
- Cohen, A. M., & Brawer, F. B. (2008). *The American community college* (5th ed.). San Francisco, CA: Jossey-Bass.

- Cohen, A. M., & Ignash, J. M. (1994). An overview of the total credit curriculum. *New Directions for Community Colleges, 1994(86)*, 13-29. <https://doi.org/10.1002/cc.36819948604>
- Cottingham, W. T., Newman, M. F., & Sims, D. F. (1981). Is there practical help for the part-time faculty—Our new and neglected majority? *Community College Review, 9(1)*, 12-17. <https://doi.org/10.1177/009155218100900103>
- Cross, K. P. (1985). Determining missions and priorities for the fifth generation. In W. L. Deegan & D. Tillery (Eds.), *Renewing the American community college: Priorities and strategies for effective leadership* (pp. 34-52). San Francisco, CA: Jossey-Bass.
- Department of the Interior, Bureau of Education. (1918). *Cardinal principles of secondary education: A report of the Commission on the Reorganization of Secondary Education, appointed by the National Education Association*. Washington, DC: Government Printing Office.
- Dougherty, K. J. (1994). *The contradictory college: The conflicting origins, impacts, and futures of the community college*. Albany, NY: SUNY Press.
- Dougherty, K. J. (2001). State policies and the community college's role in workforce preparation. In B. K. Townsend & S. B. Twombly (Eds.), *Community colleges: Policy in the future context* (pp. 121-147). Westport, CT: Ablex Publishing.
- Dougherty, K. J. (2002). The evolving role of the community college: Policy issues and research questions. In J. C. Smart & W. G. Tierney (Eds.), *Higher education: Handbook of theory and research* (pp. 295-348). Dordrecht, Netherlands: Springer Netherlands. https://doi.org/10.1007/978-94-010-0245-5_7
- Dougherty, K. J., & Bakia, M. F. (2000). *The new economic development role of the community college* (CCRC Brief No. 6). New York, NY: Columbia University, Teachers College, Community College Research Center.
- Dougherty, K. J., & Hong, E. (2006). Performance accountability as imperfect panacea: The community college experience. In T. Bailey & V. S. Morest (Eds.), *Defending the community college equity agenda* (pp. 51-86). Baltimore, MD: Johns Hopkins University Press.
- Eagan, M. K., Jr., & Jaeger, A. J. (2009). Effects of exposure to part-time faculty on community college transfer. *Research in Higher Education, 50(2)*, 168-188. <https://doi.org/10.1007/s11162-008-9113-8>
- Eells, W. C. (1931). *The junior college*. Boston, MA: Houghton Mifflin.
- Ehrenberg, R. G., & Zhang, L. (2005). Do tenured and tenure-track faculty matter? *Journal of Human Resources, 40(3)*, 647-659. <https://doi.org/10.3368/jhr.XL.3.647>
- Frye, J. F. (1992). *The vision of the public junior college, 1900-1940: Professional goals and popular aspirations*. New York, NY: Greenwood Press.

- Goble, L. J., Rosenbaum, J. E., & Stephan, J. L. (2008). Do institutional attributes predict individuals' degree success at two-year colleges? *New Directions for Community Colleges*, 2008(144), 63-72. <https://doi.org/10.1002/cc.346>
- Griffith, M., & Connor, A. (1994). *Democracy's open door: The community college in America's future*. Portsmouth, NH: Heineman.
- Grubb, W. N. (1989). The effects of differentiation on educational attainment: The case of community colleges. *Review of Higher Education*, 12(4), 349-74. <https://doi.org/10.1353/rhe.1989.0009>
- Grubb, W. N. (1996). *Working in the middle: Strengthening education and training for the mid-skilled labor force*. San Francisco, CA: Jossey-Bass.
- Gumport, P. J. (2003). The demand-response scenario: Perspectives of community college presidents. *The ANNALS of the American Academy of Political and Social Science*, 586, 38-61. <https://doi.org/10.1177/0002716202250210>
- Hossler, D., Shapiro, D., Dundar, A., Ziskin, M., Chen, J., Zerquera, D., & Torres, V. (2012). *Transfer and mobility: A national view of pre-degree student movement in postsecondary institutions* (Signature Report No. 2). Herndon, VA: National Student Clearinghouse Research Center.
- Huffman, J. P., Jr., & Schneiderman, S. (1997). *Size matters: The effect of institutional size on graduation rates*. Paper presented at the annual forum of the Association for Institutional Research, Orlando, FL.
- Jacoby, D. (2006). Effects of part-time faculty employment on community college graduation rates. *The Journal of Higher Education*, 77(6), 1081-1103. <https://doi.org/10.1353/jhe.2006.0050>
- Jenkins, D. (2007). Institutional effectiveness and student success: A study of high-and low-impact community colleges. *Community College Journal of Research and Practice*, 31(12), 945-962. <https://doi.org/10.1080/03601270701632057>
- Jolley, G. J. (2013). *Predicting North Carolina's job market in 2020*. Retrieved from <https://iei.ncsu.edu/wp-content/uploads/2013/01/JobMarket.pdf>
- Kalleberg, A. L., & Dunn, M. (2015). Institutional determinants of labor market outcomes for community college students in North Carolina. *Community College Review*, 43(4), 224-244. <https://doi.org/10.1177/0091552115576565>
- Kasper, H. T. (2002). *The changing role of community college*. Retrieved from <http://www.bls.gov/careeroutlook/2002/winter/art02.pdf>
- Koos, L. (1926). *The junior-college movement*. Oxford, UK: Ginn and Company.
- Kuo, E. W. (1999). *Analysis of ESL course offerings in community colleges*. Unpublished manuscript, University of California, Los Angeles.

- Lee, J. (2012). College for all: Gaps between desirable and actual P-12 math achievement trajectories for college readiness. *Educational Researcher, 41*(2), 43-55. <https://doi.org/10.3102/0013189X11432746>
- Leitzel, T. C., & Clowes, D. A. (1991). The diverted dream revisited. *Community Services Catalyst, 24*(1), 21-25.
- Lombardi, J. (1964). Emergent issues in administration. *Junior College Journal, 35*(3), 4-8.
- Marcus, R. D. (1989). Freshmen retention rates at U.S. private colleges: Results from aggregate data. *Journal of Economic and Social Measurement, 15*(1), 37-55.
- McGuire, J. (1993). Part-time faculty: Partners in excellence. *Leadership Abstracts, 6*(6), 2-3.
- Mobley, C. (2001). The impact of community colleges on the school-to-work transition: A multilevel analysis. *Community College Review, 28*(4), 1-30. <https://doi.org/10.1177/009155210102800401>
- Mobley, C. (2002). Community colleges and the school-to-work transition: A multilevel analysis. *Sociological Inquiry, 72*(2), 256-284. <https://doi.org/10.1111/1475-682X.00016>
- North Carolina Community College System. (2002). *2002 critical success factors report*. Raleigh, NC: Author.
- North Carolina Community College System. (2003a). *2002-2003 annual statistical reports* (Vol. 38). Raleigh, NC: Author.
- North Carolina Community College System. (2003b). *2003 critical success factors report*. Raleigh, NC: Author.
- North Carolina Community College System. (2004). *2004 critical success factors report*. Raleigh, NC: Author.
- North Carolina Community College System. (2005). *2005 critical success factors report*. Raleigh, NC: Author.
- North Carolina Community College System. (2006). *2006 critical success factors report*. Raleigh, NC: Author.
- North Carolina Community College System. (2007). *2007 critical success factors report*. Raleigh, NC: Author.
- North Carolina Community College System. (2008a). *2008 critical success factors report*. Raleigh, NC: Author.
- North Carolina Community College System. (2008b). *A matter of facts: The North Carolina Community College System fact book*. Raleigh, NC: Author.
- North Carolina Community College System. (2009). *2009 critical success factors report*. Raleigh, NC: Author.

- North Carolina Community College System. (2010). *2010 critical success factors report*. Raleigh, NC: Author.
- North Carolina Community College System. (2011). *2011 critical success factors report*. Raleigh, NC: Author.
- North Carolina Community College System. (2012). *2012 critical success factors report*. Raleigh, NC: Author.
- North Carolina Community College System. (n.d.). *Get the facts*. Retrieved from <http://www.nccommunitycolleges.edu/get-facts>
- North Carolina State Board of Community Colleges. (2004). *State Board of Community Colleges code 1A SBCC 300.1: Establishing service areas for colleges*. Retrieved from <http://www.nccommunitycolleges.edu/sbcccode/1a-sbcc-3001-establishing-service-areas-colleges>
- Palmer, J. (1999). A statistical portrait of the non-liberal arts curriculum. *New Directions for Community Colleges, 1999(108)*, 31-38. <https://doi.org/10.1002/cc.10803>
- Pintrich, P. R., & Schunk, D. H. (1996). *Motivation in education: Theory, research, and applications*. Englewood Cliffs, NJ: Merrill Publishing.
- Roksa, J. (2006). Does the vocational focus of community colleges hinder students' educational attainment? *The Review of Higher Education, 29(4)*, 499-526. <https://doi.org/10.1353/rhe.2006.0038>
- Saupe, J. L., Smith, T. Y., & Xin, W. (1999). *Institutional and student characteristics in student success: First-term GPA, one-year retention and six-year graduation*. Paper presented at the annual Association for Institutional Research Forum, Seattle, WA.
- Schuyler, G. (1999). A historical and contemporary view of the community college curriculum. *New Directions for Community Colleges, 1999(108)*, 3-15. <https://doi.org/10.1002/cc.10801>
- Sjoberg, C. E. (1999). *The relationship of environmental predictors and institutional characteristics to student persistence* (Doctoral dissertation). ProQuest Dissertations and Theses database (Order No. 9942471).
- Toutkoushian, R. K., & Smart, J. C. (2001). Do institutional characteristics affect student gains from college? *The Review of Higher Education, 25(1)*, 9-61. <https://doi.org/10.1353/rhe.2001.0017>
- Truman Commission Report. (1947). *Establishing the goals*. Washington, DC: U.S. Government Printing Office.
- Walden, M. (2014). *You decide: Why is unemployment still so high?* [Press release]. Retrieved from <https://www.cals.ncsu.edu/agcomm/news-center/media-releases/you-decide-why-is-unemployment-still-so-high>

Notes

Note 1. Most colleges we classified as comprehensive or non-specialized had homepages that reflected both academic- and career-oriented messaging as opposed to explicitly comprehensive messaging, but certain colleges also had comprehensive messaging.

Note 2. The North Carolina State Board of Community Colleges designates a unique service area for each community college. We assigned all labor market variables to community colleges based on these service area designations. Most service areas use counties as lines of demarcation, though some serve multiple counties. We combined and averaged the labor market values for community colleges that span multiple counties.

Note 3. Community college service areas are decided by the NCCCS governing board, which takes into account “the past and present patterns of providing services, including existing agreements between colleges” (North Carolina State Board of Community Colleges, 2004).

Note 4. We manually created and coded this variable by identifying UNC campuses and then matching them to community college service areas.

Note 5. We use the population density measure from the 2010 U.S. Census data.

Note 6. Given the drastic increase in unemployment beginning in 2008 and the subsequent partial recovery by 2010, we decided to calculate the average unemployment during the period so as to provide a more accurate depiction of how unemployment rate might affect workers’ labor market opportunities during this period. We then created an ordinal variable that represented colleges 2 percent or greater below the State average, within 2 percent in either direction, and greater than 2 percent above the state average.

Note 7. We calculated this using the FTE of continuing education enrollments divided by the overall FTE enrollment.

Note 8. We calculated this by dividing the number of applied curriculum course offerings by the overall number of curriculum course offerings in each community college. Applied courses are identified within the community college system as non-general education courses. These courses are curriculum courses assigned to terminal degrees, diplomas, or certificates not associated with a transfer program.

Note 9. These data thus exclude continuing education and non-credit-seeking students, as well as credit-seeking students enrolled in customized programs created for a specific business or industry. The college transcript data were merged with student-level data from NSC, which tracks students as they transfer to other Title IV-eligible colleges. This was important, as more than one third of community college students transfer to other Title IV-eligible colleges (Hossler et al., 2012).

Copyright Disclaimer

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/3.0/>).