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Faculty and programmatic influences on the percentage of graduates of color from professional physical therapy programs in the United States

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Abstract
The physical therapy profession in the United States suffers from a shortage of providers of color. This is unlikely to change with newly graduating students, as 2.6% of 2017 graduates were African American and 5.7% were Hispanic or Latino. Faculty mentorship has a more profound influence on the retention of underrepresented minority students as compared with students from privileged backgrounds, according to undergraduate literature. The influences of faculty characteristics on physical therapy graduates of color are unknown. The purpose of this study was to determine faculty and programmatic characteristics that could influence the percentage of physical therapy graduates of color. This study implemented the theory of academic capitalism to inform the results of a retrospective panel analysis, which used accreditation data from 2008 to 2017. Data from 231 programs was used to create fixed effects and random effects models to estimate the effects that faculty and program characteristics had on the percentage of graduates of color that a program produced. There was a statistically significant positive relationship between faculty of color and graduates of color ($p < 0.001$), but faculty must be sufficiently diverse before a program can expect a meaningful change in their percentage of graduates of color. Academic capitalist principles suggest that competition between programs for resources could negatively influence the proportion of graduates of color. Cause and effect associations between variables cannot be established. The authors concluded that professional physical therapy programs appeared to have increases in the percentages of graduates of color when they had more core faculty members of color.

Keywords Academic capitalism · Accreditation · Faculty of color · Graduate student retention · Panel analysis · Physical therapy education · Students of color

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Introduction

In the United States, the physical therapy profession suffers from a shortage of providers of color (Cook 2017). As of 2013, 1.2% of American Physical Therapy Association (APTA) members were African American and 2.4% were Hispanic or Latino. By contrast, 91.7% self-identified as white, non-Hispanic (Physical Therapist Member 2013). In comparison, 14.1% of United Stated citizens self-identified as African American and 18.3% self-identified as Hispanic or Latino (ACS Demographic 2018). The data from the APTA only represents those who are members of the professional association and does not represent the entirety of the physical therapy community, but this does highlight the discrepancy between providers of color in relation to the country's overall population.

The percentage of providers of color in the United States is not likely to increase substantially with newly graduating students. According to the Commission on Accreditation in Physical Therapy Education (CAPTE), 2.6% of 2017 physical therapy graduates were African American and 5.72% were Hispanic or Latino (2017–2018 Physical Therapist 2017). This trend is concerning as it can lead to health disparities in underrepresented populations. It is well known that under-represented minority groups are treated unequally within the healthcare system, even when controlling for accessibility (Jackson and Gracia 2014; Smedley et al. 2003). Most speculate that this trend can be mitigated with a more diverse healthcare workforce.

A barrier to improving the diversity of the physical therapy workforce could be the rising costs of tuition among programs. Allen and Wolniak (2015) found that, "all else equal, a $1000 tuition increase for full-time undergraduate students is associated with a drop in campus diversity of almost 6 percent," (p. 30). The total cost of a DPT program in 2008 was $38,240 for public in-state tuition, and $76,305 for a private institution on average (2007–2008 Fact Sheet 2008). By 2018 the cost climbed to $60,627 for public in-state and $109,099 for private institutions (2017–2018 Physical Therapist 2017).

This is unlikely to change, as institutions are becoming more tuition-dependent over time (Taylor and Cantwell 2019). There is also evidence that institutions adopt new physical therapy programs in response to rising institutional expenditures (Dickson and Taylor 2019). These studies together suggest that students may be negatively impacted by changes in higher education funding. The following research question guided this study: What faculty and programmatic resources from physical therapy programs were correlated with producing a higher percentage of graduates of color in the United States?

Theoretical framework

We used the theory of academic capitalism as the guiding framework for this study. Academic capitalism is the phenomenon whereby institutions of higher education are subjected to competitive market-like forces (Rhoades and Slaughter 1997). However, because of the complexity of higher education institutions, colleges and universities behave in ways that are different from those within a purely capitalist market (Rhoades and Slaughter 1997). Institutions become more "successful" not if they operate efficiently (i.e. producing more graduates at a lower cost), but when they operate effectively (i.e. producing highly knowledgeable and capable graduates) (Archibald and Feldman 2006).

Effectiveness as defined within education results in increasingly higher costs (Archibald and Feldman 2006). Most prospective students, particularly prospective professional students,

aspire to attend colleges and universities that are prestigious or are known to give students a competitive edge in the next phase of their training (Taylor and Cantwell 2019). Thus, institutions are more competitive in the eyes of students if they can attract highly qualified faculty, produce cutting-edge research, provide state-of-the-art facilities, and attract other highly qualified students. These top institutions can be thought of as being "elite" (Taylor and Cantwell 2019).

In fact, Dickson et al. (In Press) found that graduation rates from physical therapy programs were maximized when faculty devoted approximately 25% of their time to scholarship, though the average among all programs is approximately 17%. Their results indicated that research prowess among programs may be impacting the perceptions of prestige among prospective students. As program faculty become more research-intensive, programs may be attracting students with more academically enhanced transcripts.

Students who enter programs with higher GPAs and GRE scores have been shown to have less academic difficulty in physical therapy programs (Utzman et al. 2007). Thus, our theoretical framework suggests that higher research intensiveness may translate into "better" student outcomes for the majority (Dickson et al. 2019). Current evidence suggests that students who are white and of a privileged background are also more likely to attend an elite institution (Taylor and Cantwell 2019), complete their degrees (Astin 1993; Mayhew et al. 2016), and enter into faculty careers (Huang et al. 2016). Academic capitalism, then, suggests that the current system of higher education perpetuates inequality (Taylor and Cantwell 2019).

Such meritocracy negatively impacts students of color (Littler 2013, 2018). Prior literature reveals that students of color, those who are older in age, and those who have had lower GPAs and GRE scores tend to be at a higher risk of academic difficulty within physical therapy programs (Cook et al. 2015; Jewell and Riddle 2005; Riddle et al. 2009; Utzman et al. 2007). These trends have resulted in admissions practices that focus, in part, on standardized testing, which is known to adversely impact acceptance rates for students of color, even when controlling for socioeconomic status (Bensimon 2007). Prior research also suggests that those programs with higher expenses per student and a higher ratio of full-time core faculty per student are more likely to have 100% pass rates on the National Physical Therapy Exam (Covington et al. 2016), indicating that students in programs with more resources are likely to have better outcomes.

Professional physical therapy programs are faced with the need to continue their teaching efforts to justify tuition hikes. At the same time, they also need to boost research efforts to compete with other departments and maintain accreditation requirements for faculty scholarship (Standards and Required 2017). This study seeks to understand faculty and programmatic influences on the percentage of graduates of color a physical therapy program produces. We hypothesized that programs with more faculty resources—including more core faculty members, fewer faculty vacancies, proportionately fewer part-time faculty, more specialists and academic doctoral degrees, and lower student to core faculty ratios—would have proportionately fewer graduates of color. Similarly, we hypothesized that those programs with more programmatic resources—including a higher total cost, higher expenses, higher number of students, and longer program length—would have proportionately fewer graduates of color.

Methods

This study aimed to correlate faculty and program characteristics with the percentage of graduates of color over a ten-year period. Therefore, data from 2008 to 2017 was captured using data from the CAPTE Annual Accreditation Reports (AAR). Data were analyzed using STATA 14.2© statistical software (StataCorp 2015). The Institutional Review Board at the University of North Texas exempted this study.

The sample included all CAPTE accredited programs within the US between 2008 and 2017, excluding for-profit programs. Non-profit organizations rely on public funding (through federal, state, and local appropriations) and private funding (through donors and student tuition), while for-profit organizations run based on "market demand for services" only (Toutkoushian 2001). For-profit institutions therefore operate based on capitalism, which is inherently different from the academic capitalist framework that was utilized in this study. Thus, for-profit institutions were seen as less likely to compete with other institutions for the ideals of prestige and excellence and therefore were excluded from the study.

Variables

The variables of interest for this study were chosen prior to the analysis and are listed in Table 1. The dependent variable was the percentage of graduates of color. For the purposes of this study, a person of color was one who self-identified in an ethnic/racial category other than white/non-Hispanic (Turner et al. 2008). Independent variables included an array of faculty and program characteristics that were available from the AAR at the time of data collection and could theoretically impact graduates of color according to our academic capitalist framework.

We theorized that highly competitive programs would have access to better faculty resources as compared to programs that were financially struggling, and that these programs would also note relatively fewer graduates of color (Taylor and Cantwell 2019). Academic capitalism suggests that competitive programs would be more likely to have a larger faculty and more robust research programming due to their ability to generate revenues (Taylor 2016).

Similarly, more competitive programs may be more willing to award tenure and rely less heavily on part-time faculty members (Kezar and Sam 2010). Competitive programs would be more likely to attract faculty with research experience, and thus those programs would note higher proportions of faculty members with specialist certifications, academic doctoral degrees, research funding, and peer-reviewed publications (Zhang and Ehrenberg 2010). Programs that are less competitive might have difficulty filling core faculty positions and thus have more vacancies and faculty with fewer years of experience.

Program variables were similarly chosen based on the academic capitalist framework. We theorized that programs that had higher expenses per student would likely have more robust research endeavors (Taylor 2016). Research efforts could also negatively impact the tuition-dependence of a program and therefore the total cost of a program. We theorized that the number of students, program length, and time in both didactic and clinical education may be functions of tuition revenues and potentially indicators of a program's tuition dependence and competitiveness (Taylor and Cantwell 2019; Tight 2013). Programs that have been accredited for longer periods of time are also likely to be more competitive (Taylor and Cantwell 2019).

Table 1 Definitions of study variables

Dependent variable	
% Graduates of color	Number of program graduates who self-identify in an ethnic/racial category other than white/non-Hispanic divided by the total number of graduates from that program
Independent variables	
Faculty characteristics	
Number of core faculty	Number of core faculty FTEs in the program
% Tenured or tenure-track faculty	(Number of tenured faculty + number of non-tenured (on tenure track) faculty)/number of core faculty
% Faculty vacancies	Vacancies in currently allocated (budgeted) faculty positions/total number of faculty positions budgeted
Faculty years of experience	Mean number of years of experience of core faculty as a faculty member in any program
Student to core faculty ratio	Number of students in each class/number of core faculty
% Specialist faculty	Number of core faculty with APTA specialty certifications/number of core faculty
% Faculty of color	(Number of faculty members who self-identify in an ethnic/racial category other than white/non-Hispanic)/number of core faculty
% Part-time faculty	Total number of part-time core faculty/(Total number of full-time core faculty + total number of part-time core faculty)
% Funded faculty	Number of core faculty with funded grants/number of total core faculty
% Faculty with an academic doctoral degree	Number of faculty members with a professional doctorate (EdD, DSc, etc.) or a PhD/number of core faculty
% Faculty time devoted to teaching in the entry-level program	Mean % of core faculty members' time devoted to teaching
% Faculty time devoted to scholarship	Mean % of core faculty members' time devoted to scholarship
% Faculty time devoted to clinical practice	Mean % of core faculty members' time devoted to clinical practice
Number of publications per faculty member	Number of peer-reviewed articles published (excluding abstracts)/number of core faculty
Program Characteristics	
Institutional control	Dichotomous variable: Public or private not-for-profit
Total cost of the program	Expected total cost of the program for a given student (excluding meals, housing, and clinical education travel) (calculated using in-state tuition for public programs)
Expenses per student	(Total budgeted operating expenses + total budgeted core faculty and staff salary expenses for the program)/number of students enrolled
Program length	Total length of didactic and clinical portions of the physical therapy program (in weeks)
Time in didactic instruction	Contact/clock hours of didactic and laboratory instruction
Time in clinical education	Contact/clock hours of clinical education
Number of students	Total of 1st, 2nd, and 3rd year students in the program
Years accredited	Years since the program initially earned accreditation from CAPTE

Table 1 (continued)

Control variables	
Degree awarded	DPT, Combined BS/DPT, MPT, MS, MSPT, BS/MS, or Other
Carnegie classification	As classified by guidelines set in 2015 ("The Carnegie," 2015)
State	State in which the program is located within the United States
Curriculum model	Categorical variable: case-based, lifespan-based, problem-based, modified problem-based, systems-based, "Guide"-based, traditional, or hybrid

Control variables included Carnegie classification, institutional control, geographic location, and curricular model. Total cost of the program and expenses per student were adjusted for inflation using the 2017 Higher Education Price Index.

Analysis

We conducted both fixed and random effects analyses on our data. Unlike studies using cross-sectional data, results from panel data provide estimates of both within- and between-institution effects (Cameron and Trivedi 2009). These results provide more efficient and consistent estimates of how a single program's outputs can be altered given changes in a single variable. Cross-sectional analyses, on the other hand, provide an estimate of a single point in time among a heterogeneous sample of programs. Panel data are able to provide these estimates by tracking how a given program's inputs and outputs change over time (Zhang 2010). Fixed effects models further provide estimates of within-program effects and relieve effects of omitted variable bias, since time-independent variables are accounted for (Cameron and Trivedi 2009; Zhang 2010). The estimates from a well-specified random effects model, however, are highly desirable because they are uncorrelated with one another.

Random effects models should not be used over fixed effects models if the fixed effects model is deemed more appropriate because the estimates that the random effects models provide will be inconsistent (Cameron and Trivedi 2009). We tested for the appropriateness of using a fixed effects model by using a Hausman test, which detects endogenous effects in a fixed effects model (Cameron and Trivedi 2009; Zhang 2010). If the null hypotheses from the Hausman specification test were true, we would assume that the random effects model provided more accurate predictions for relationships between the variables of interest (Cameron and Trivedi 2009; Zhang 2010; Hausman Specification Test 2016).

Results

CAPTE provided data for 249 physical therapy programs. Five were excluded from the dataset because of their for-profit institutional status, and five were excluded due to incomplete data. Eight programs were not accredited until 2018 and therefore excluded, leaving a total of 231 programs in the study. Descriptive statistics for the continuous variables captured for the programs are listed in Table 2.

Table 2 Descriptive statistics of continuous variables

	Mean	Standard deviation	25th percentile	Median	75th percentile
Dependent variable					
% Graduates of color	17.8	17.2	6.0	15.0	28.3
Independent variables					
Faculty characteristics					
Core faculty FTE	10.7	4.3	7.5	9.0	12.0
% Tenured or tenure-track faculty	55.1	31.0	35.7	60.0	83.0
% Faculty vacancies	5.4	7.6	0	0	11.0
Faculty years of experience	13.5	3.7	10.3	12.6	15.3
Student to core faculty ratio	11.3	3.3	9	11	13
% Specialist faculty	39.5	16.8	28.6	40.0	53.3
% Faculty of color	12.4	16.9	0	9.1	20.0
% Part-time faculty	7.7	12.9	0	0	12.5
% Funded faculty	30.3	28.3	11.0	25.0	41.0
% Faculty with an academic doctoral degree	48.0	10.2	42.5	49.3	54.8
% Faculty time devoted to teaching in the entry-level program	63.6	17.7	50.0	63.6	77.8
% Faculty time devoted to scholarship	18.5	8.4	11.9	17.0	22.5
% Faculty time devoted to clinical practice	5.9	5.4	1.8	4.5	8.4
Publications per faculty FTE	1.0	1.1	0.3	0.6	1.2
Program characteristics					
Total cost of the program	$67,516	$30,905	$42,907	$66,274	$87,152
Program expenses per student	$11,129	$5999	$7656	$9545	$12,474
Program length (weeks)	121.6	14.3	115	122	131
Time in didactic education (hours)	1821.2	599.3	1625	1776	2001
Time in clinical instruction (hours)	1440.1	197.0	1280	1440	1520
Number of students	122.1	49.9	81	107	141
Years since accreditation	29.8	21.0	14	26	41

There were 2144 observations within the sample, which included yearly data from 231 programs. Of those, less than 9% of the data were missing for all variables with the exception of the percentage of graduates of color (12.3% of data missing), and faculty time devoted to teaching (19.1% of data missing). Listwise deletion was used to handle the missing data. The natural log of values for total cost of the program, program expenses per student, program length, publications per faculty FTE, time in clinical education, time in didactic education, student enrollment, and years since the program earned accreditation were calculated and used in the prediction models for ease of interpretation in the final analysis. This also allowed us to control for scale of larger programs and to more effectively handle any possible outliers.

Table 3 displays the overall graduation rates, the percentage of graduates of color, and the percentage of faculty of color by institutional control and Carnegie classification. Table 4 shows the total cost of a program and expenses per student by institutional control and Carnegie classification. In looking at Table 3, it appears that faculty of color represent a higher proportion of physical therapy faculty in public institutions that reside within master's colleges and universities—smaller programs (36.8% in public institutions) as well as doctoral universities with moderate research activity (24.7% in public and 19.6% in private). Table 3 also reveals that these programs typically have lower graduation rates (ranging from 88.2 to 93.2%) but more graduates of color (ranging from 20.1 to 37.8%). At the same time, Table 4 reveals that public master's colleges and universities—smaller programs have a lower total cost for programs ($32,021 for in-state students) and higher expenses per student, on average ($18,636 yearly), than programs in other Carnegie classifications. The private doctoral universities with the highest research activity also graduated a larger percentage of graduates of color (26.6%), but they tended to have a higher total cost ($102,339) and more expenses per student, on average ($22,709 yearly), than programs in other Carnegie classifications.

Graduates of color

Our research question involved programmatic and faculty resources that predicted the percentage of graduates of color a program produced. We regressed the correlates against the percentage of graduates of color first using a fixed effects model. We performed an F-test for joint significance, with $p < 0.001$, which indicated that it was appropriate to conduct a panel analysis on the data. The test for serial correlations yielded a $p = 0.183$, indicating that cluster-robust standard errors were not needed to avoid false-positive results. The results of the fixed effects model are listed in "Appendix".

Hausman specification testing generated a $p = 0.821$, indicating that the null hypothesis that the random effects model provided more efficient and consistent estimates for interpretation over the fixed effects model could not be rejected. Therefore, the random effects model was interpreted. Table 5 provides a full listing of the results from the random effects model with the percentage of graduates of color being the dependent variable.

The results indicated that a one percentage point increase in faculty of color was associated with a 33% increase in graduates of color (the correlation coefficient was 0.33). We tested for a non-linear relationship between graduates and faculty of color by squaring the faculty of color term and re-running the model. The F-test for joint significance yielded $p < 0.001$, indicating that a non-linear relationship between faculty and graduates of color existed.

We then tested for a possible interaction effect between institutional control and Carnegie classification on the percentage of faculty and graduates of color. Multiplicative

interaction variables between (1) faculty of color, the squared faculty of color term, and institutional control and (2) faculty of color, the squared faculty of color term, and Carnegie classification were created (Brambor et al. 2006). We performed an F-test for joint significance between the four variables in each case: (1) faculty of color, the squared faculty of color term, institutional control, and the interaction term; and (2) faculty of color, the squared faculty of color term, Carnegie classification, and the interaction term. Results ($p < 0.001$ in both cases) indicated that there was likely an interaction effect between faculty of color and both institutional control (correlation coefficient = − 0.06) and Carnegie classification (correlation coefficient = − 0.02) on the percentage of graduates of color from professional physical therapy programs. Interaction effects indicate that programs in public and/or less research-intensive institutions noted a stronger relationship between faculty of color and graduates of color than other institutional types.

The graphical representation of the prediction model, which includes the interaction terms mentioned above, provides a more straightforward representation of our findings (Fig. 1). There is a positive, but non-linear relationship between faculty of color and graduates of color. Results indicate that faculty of color must be a significant makeup of a program's faculty before a program can expect a meaningful change in their percentage of graduates of color—close to 20%.

The random effects model also found that, for a single additional core faculty FTE, a program could expect a 6% decline in graduates of color (correlation coefficient = − 0.06). Figure 2 illustrates the relationship between core faculty FTE and the predicted percentage of graduates of color. There is a negative, logarithmic relationship present, indicating a diminishing drop in the rate of graduates of color as core faculty FTE increase. Results indicate that there is likely not a practically meaningful decline in the percentage of graduates of color for programs with larger numbers of core faculty. For example, programs that increase core faculty size from 3 to 5 members can expect their graduates of color to decline by three percentage points, but programs that increase faculty size from 12 to 14 members would expect their graduates of color to decline by approximately one percentage point. While this result is statistically significant, it may not be practically meaningful.

We tested for interaction effects of institutional control and Carnegie classification on core faculty FTE using the same methods as described for the percentage faculty of color variable. However, the results of the F-test for joint significance indicated that there was not a statistically significant interaction effect between the number of core faculty and institutional control ($p = 0.058$) or Carnegie classification ($p = 0.49$).

Discussion

We found that for a one percentage point increase in the faculty of color, a program could expect a 33% increase in its graduates of color. The strong, positive correlation between faculty of color and graduates of color is not surprising and has been documented numerous times within undergraduate and dentistry literature (Alger 1997; Veal et al. 2004; Rogers and Molina 2006; Price and Grant-Mills 2010). Physical therapy students who classified themselves as minorities reported a high level of influence of physical therapy faculty, as well as the influence of ethnic, culture, and gender considerations, on their choice of a physical therapy program (Wilcox et al. 2005). Our study expands on this work by demonstrating the strength of the association between students and faculty of color.

Table 3 Overall graduation rates, graduates of color, and faculty of color by institutional control and carnegie classification

Carnegie classification	Graduation rate		Faculty of color		Graduates of color	
	Public (%)	Private (%)	Public (%)	Private (%)	Public (%)	Private (%)
Doctoral universities: highest research activity	95.7	94.1	6.9	15.6	14.2	26.6
Doctoral universities: higher research activity	94.9	90.5	11.2	17.1	14.8	25.3
Doctoral universities: moderate research activity	93.2	92.6	24.7	19.6	20.1	23.6
Master's colleges and universities: larger programs	95.3	92.3	13.9	6.9	18.3	15.3
Master's colleges and universities: medium programs	93.8	89.8	16.0	11.7	16.7	15.5
Master's colleges and universities: smaller programs	88.2	92.4	36.8	18.2	37.8	18.1
Baccalaureate colleges: arts and sciences and diverse fields		93.2		6.7		14.6
Special focus four-year: medical schools and centers	95.0	95.5	19.4	11.3	17.6	20.4
Special focus four-year: other health professions schools		95.0		8.4		24.7
Not classified		97.0		17.1		21.2

Table 4 Distribution of total cost and expenses per student by institutional control and carnegie classification

Carnegie classification	Total cost		Expenses per student	
	Public (in-state)	Private	Public (in-state)	Private
Doctoral Universities—Highest Research Activity	$54,370	$102,339	$13,186	$22,709
Doctoral Universities—Higher Research Activity	$45,259	$96,427	$8796	$11,104
Doctoral Universities—Moderate Research Activity	$45,710	$91,032	$10,467	$9155
Master's colleges and universities—larger programs	$43,174	$86,187	$10,404	$9601
Master's colleges and universities—medium programs	$54,077	$74,530	$14,103	$9217
Master's colleges and universities—smaller programs	$32,021	$85,233	$18,636	$10,128
Baccalaureate colleges—arts and sciences and diverse fields		$82,957		$10,146
Special focus four-year—medical schools and centers	$42,398	$87,436	$10,346	$10,222
Special focus four-year—other health professions schools		$103,199		$13,292
Not classified		$78,894		$11,455

The major contribution of this paper is its use of academic capitalism to underscore the economic relationship between faculty and students of color in a given health profession. Faculty of color historically have been underrepresented in highly selective institutions, and department chairs have noted difficulties in recruitment of faculty members of color (Gasman et al. 2011; Tierney and Sallee 2008). Students of color are similarly underrepresented in such institutions (Jack 2019). Thus, academic capitalism and competition between programs for resources may result in the stratification of individuals by "merit," which may be reflective in the higher proportions of persons of color in less selective programs (Taylor and Cantwell 2019; Littler 2013, 2018).

We correctly hypothesized that additional core faculty FTE had a negative influence on the percentage of graduates of color, though the effect was arguably not practically meaningful according to our prediction model. The median program had only about 9% of its faculty consist of persons of color (Table 2). Therefore, it is likely that our resulting impact of increasing core faculty FTE reflect the addition of faculty members who are not persons of color. We believe this explains the paradoxical findings of a decline in graduates of color with additional core faculty members that was not seen with the addition of faculty members of color. Our theoretical framework would suggest that programs with higher monetary resources can afford to hire larger numbers of faculty members. Such programs would similarly sponsor robust research endeavors and hire more experienced faculty members. Programs who increase their core faculty size may be simultaneously noting rises in status, therefore negatively impacting the chances that prospective students of color must compete in a meritocratic environment (Littler 2013, 2018).

The present study did not observe the correlations between program selectivity and graduates of color. Counter to our hypotheses, the percentage of graduates of color was not statistically related to other program-specific variables, including institutional control,

Table 5 Percentage of graduates of color using the random effects model

Variable	Correlation coefficient	*p*-value	95% CI
Faculty characteristics			
Core faculty FTE	−0.060	0.045*	−0.12–− 0.0013
% Tenured or tenure-track faculty	0.046	0.099	−0.0087–0.10
% Faculty vacancies	−0.078	0.318	−0.23–0.075
Faculty years of experience	−0.021	0.414	−0.070–0.029
Student to core faculty ratio	0.019	0.399	−0.0026–0.0064
% Specialist faculty	0.023	0.575	−0.057–0.10
% Faculty of color	0.33	< 0.001*	0.24–0.43
% Part-time faculty	0.079	0.069	−0.0061–0.16
% Funded faculty	−0.028	0.159	−0.067–0.011
% Faculty with an academic doctoral degree	−0.0013	0.185	$-0.0031–6.1\times10^{-4}$
% Faculty time devoted to teaching in the entry-level program	8.9×10^{-5}	0.371	$-3.7\times10^{-4}–9.9\times10^{-4}$
% Faculty time devoted to scholarship	−0.0012	0.334	−0.0036–0.0013
% Faculty time devoted to clinical practice	-6.7×10^{-5}	0.961	−0.0028–0.0026
Number of peer-reviewed publications per faculty FTE	−0.0043	0.824	−0.033–0.042
Program Characteristics			
Institutional control	0.040	0.106	−0.0086–0.089
Total cost of the program to students	0.016	0.507	−0.037-0.087
Program expenses per student	0.023	0.330	−0.037–0.082
Program length	4.2×10^{-4}	0.994	−0.46–0.0046
Time in didactic education	−0.0063	0.686	−0.021–0.074
Time in clinical education	−0.017	0.681	−0.11–0.079
Number of students	0.020	0.574	−0.049–0.089
Years accredited	0.014	0.173	−0.0062–0.034

Table 5 (continued)

Variable	Correlation coefficient	*p*-value	95% CI
Control variables			
Year			
2012	−0.030	0.114	−0.067–0.0071
2013	−0.032	0.095	−0.071–0.0057
2014	0.0014	0.949	−0.041–0.043
2015	−0.0093	0.657	−0.051–0.032
2016	−0.0030	0.886	−0.044–0.038
2017	1.1×10^{-4}	0.996	−0.043–0.043
Carnegie Classification			
Special focus four-year: other health professions schools	−0.076	0.565	−0.36–0.18
Special focus four-year: medical schools and centers	−0.096	0.459	−0.35–0.16
Baccalaureate colleges—diverse fields and arts & sciences	−0.13	0.322	−0.40–0.13
Master's colleges and universities: smaller programs	−0.17	0.219	−0.43–0.10
Master's colleges and universities: medium programs	−0.14	0.294	−0.39–0.12
Master's colleges and universities: larger programs	−0.12	0.331	−0.38–0.13
Doctoral universities—moderate research activity	−0.14	0.289	−0.39–0.12
Doctoral universities—higher research activity	−0.11	0.375	−0.36–0.15
Doctoral universities—highest research activity	−0.090	0.491	−0.35–0.17
Degree			
DPT	−0.011	0.782	−0.085–0.064
MPT	−0.090	0.118	−0.20–0.023
MS	−0.14	0.328	−0.42–0.14
MSPT	−0.0072	0.960	−0.29–0.27
Curriculum Model			
Guide-based	0.0097	0.952	−0.31–0.33

Table 5 (continued)

Variable	Correlation coefficient	*p*-value	95% CI
Hybrid	−0.03	0.797	−0.31–0.24
Lifespan-based	−0.15	0.357	−0.48–0.17
Modified problem-based	−0.029	0.838	−0.31–0.24
Problem-based	−0.026	0.857	−0.31–0.26
Systems-based	−0.39	0.780	−0.32–0.24
Traditional	0.0079	0.955	−0.27–0.28

Note: * indicates $p < 0.05$

Carnegie classification, total cost of the program, expenses per student, program length, or number of students.

Melguizo (2008) found a closure of the achievement gap among undergraduate students of color when they entered highly selective institutions. The present research is unable to comment on retention of students of color specifically. However, considering the high graduation rate among all physical therapy programs (93.8% on average), it does not appear that students of color specifically are at a significant disadvantage in terms of achieving a physical therapy degree. This may be because students who have succeeded to the professional phase of their training are likely to continue to have the resilience necessary to achieve their academic goals.

Considering that the mean percentage of graduates of color from 2008 to 2017 was 17.8%, and the population average of individuals of color in the United States is around 40% (ACS demographic 2018), additional study is warranted. A discrepancy of licensed physical therapists of this magnitude likely negatively impacts the health of individuals of color throughout the country (Ching 2013). "Inequalities in higher education have a negative impact on the economic and social fabric of our nation in matters such as unemployment rates, welfare costs, voter turnout, income levels, and healthcare. Additionally, inequalities jeopardize our nation's ability to produce the degrees that secure our position in a global economy," (Ching 2013, p. 5). Researchers should study the effects of hiring physical therapy faculty of color on the enrollment and subsequent graduation rates of students of color.

Implications for theory

The findings of the present study underscore the value of framing research within a theoretical construct from which to inform results. The strong, positive correlation between faculty and students of color may be due not only to the potential attractiveness of diversity for prospective students of color, but also because of economic influences on both faculty and students within an institution. Theory suggests that the existing system of higher education—with its growing competition for resources as well as its emphasis on merit and

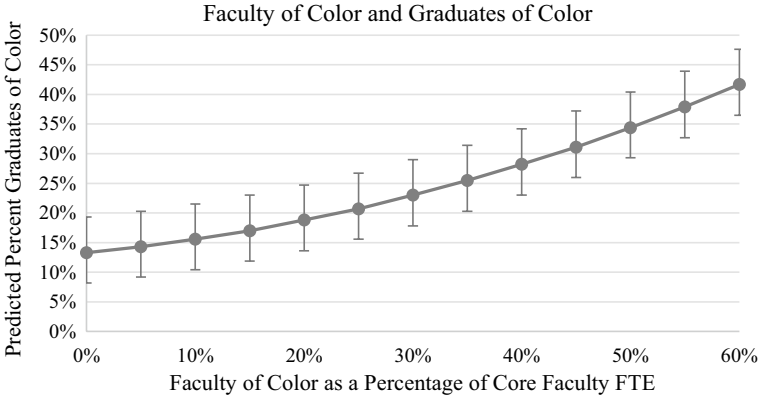

Fig. 1 Predicted percentage of graduates of color based on the percentage of faculty of color. Error bars represent 25th and 75th percentiles

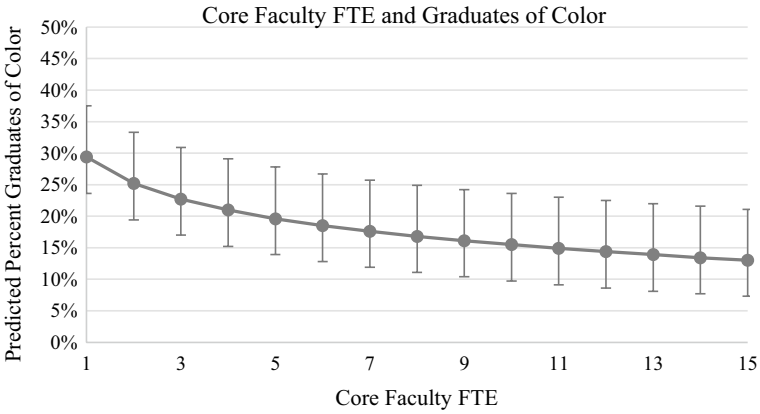

Fig. 2 Core faculty FTE in a given program. Error bars represent standard error. Error bars represent 25th and 75th percentiles

standardized test scores—appears to perpetuate inequality. Our study proposes that both may be influencing the rates of faculty and graduates of color.

Of course, not all facets of academic capitalism were supported by our findings. We did not necessarily find that graduates of color were statistically impacted by the total cost of a program or program expenses. The findings of this study initially appear contrary to literature by Taylor and Cantwell (2019), as most research to date in this area has been conducted on undergraduate student outcomes. Professional students, including physical therapy students, may be different than undergraduates in their resiliency and persistence to graduation in general. Academic capitalism may therefore have fewer impacts on graduates of color from professional physical therapy programs.

Because of the apparent resiliency of physical therapy students, it may be that students are more insulated from changes that occur within programs, faculty, and institutions as a whole. Thus, academic capitalism might be adapted for graduate health professions students in that programmatic resource investments have a smaller effect on graduation rates than they do on undergraduates. Institutions should take caution, however, before deciding to cut program resources. Student outcomes—in terms of student diversity, depth of understanding, clinical reasoning, and interpersonal skills—may be affected by changes in programmatic resource investments or faculty. However, due to the nature of the currently existing measures of health professions students, the present student cannot comment on such higher-level outcomes.

Future research

Admission into physical therapy programs is competitive, as only an average of 17% of a program's applicants were offered placement in 2017 (2017–2018 Physical 2018). Thus, those students who are able to attain acceptance must be very well prepared academically. The result of this meritocracy (Littler 2013) is, unfortunately, likely a strong contributor to the lack of students of color within physical therapy programs. Students who are both white and from privileged backgrounds have a much stronger advantage to obtain a better education in their undergraduate careers (Taylor and Cantwell 2019), and thus they are better able to outcompete other students for these highly desired seats. Littler, in her 2018

framework, argues that the appearance of meritocracy in competitive admissions practices perpetuates inequalities. For example, prior research has shown inequalities in SAT and GRE scores by race, even after controlling for education and socioeconomic status. It can be argued, then, that the appearance of competitive admissions masks inequalities by race and social class, indicating that these inequalities are "merited" when, in fact, they perpetuate the work of discriminatory social processes (Littler 2018). Further study is warranted in this area in health professions programs.

Others involved in recruitment suggest avoiding the temptation to base admissions decisions solely on GPA and standardized test scores. Studies in dental school admissions "found that cognitive measurements used in the admissions evaluation are frail indicators of dental school academic performance," (Price and Grant-Mills 2010). Studies have shown large discrepancies in achievement in standardized testing in different racial groups. Differences have been as large as 80 points on the SAT between white, black, and Asian students from the same socioeconomic class (Bensimon 2007). Thus, it is suggested that admissions processes balance both quantitative measures of academic success with qualitative measures of individual candidates in order to improve the diversity of a student body.

Limitations

There are limitations to this study for accrediting bodies and institutional leaders to keep in mind. Data from this study were self-reported by each program. Thus, there could be inherent flaws within the data, as programs may be tempted to provide inaccurate numbers in order to avoid repercussions from their accrediting body. This study also cannot comment on yearly trends outside of the study period, or on trends that are present in programs housed within for-profit institutions, as these components of physical therapy education were not studied.

We were unable to capture data regarding the number of enrolled students of color from each program. Therefore, this study is unable to determine a cause and effect relationship between faculty of color on the recruitment of students of color. Furthermore, because we were primarily interested in faculty and programmatic characteristics, our model did not incorporate student characteristics which very likely impact graduation rates, such as undergraduate GPA or GRE scores.

This study involved data from professional physical therapy programs only. Therefore, we cannot comment on the generalizability of our findings to other health professions or medicine. However, considering that prior studies in the undergraduate literature have found similar associations between graduates of color and faculty of color, it is likely that other health professions would benefit from increasing their programmatic output of students of color though efforts to attract and maintain faculty of color, along with additional other efforts to emphasize a diverse student body.

Conclusions and recommendations

Given the strong positive correlation between faculty of color and students of color, and that prior literature has shown that undergraduate students of color tend to be attracted to institutions with more faculty of color, it is reasonable that program directors would seek to hire faculty of color in an effort to improve the diversity of a program's student

body. Admissions personnel within physical therapy programs likely note that the applicant pool for students entering physical therapy programs is much less diverse than that among undergraduates. This speaks to a problem with the pipeline of qualified students. Veal et al. (2004) speak to ways to improve minority awareness of the health professions to address this problem. Among their suggestions are to provide early information to students, include minority students in recruitment efforts, and to hire minority faculty.

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Compliance with ethical standards

Conflict of interest The authors whose names are listed above certify that they have no Conflict of interest.

Appendix

Percentage of graduates of color using the fixed effects model

Variable	Correlation coefficient	*p* value	95% CI
Faculty characteristics			
Core faculty FTE	−0.11	0.011*	−0.19–−0.025
% Tenured or tenure-track faculty	0.050	0.482	−0.089–0.19
% Faculty vacancies	−0.12	0.161	−0.29–0.049
Faculty years of experience	−0.078	0.034*	−0.15–−0.0057
Student to core faculty ratio	0.0036	0.203	−0.0019–0.0091
% Specialist faculty	0.022	0.740	−0.11–0.15
% Faculty of color	0.022	0.802	−0.15–0.20
% Part-time faculty	0.056	0.260	−0.041–0.15
% Funded faculty	−0.034	0.226	−0.089–0.021
% Faculty with an academic doctoral degree	−0.0013	0.360	−0.0041–0.0015
% Faculty time devoted to teaching in the entry-level program	2.9×10^{-7}	1.000	-9.4×10^{-4}–9.4×10^{-4}
% Faculty time devoted to scholarship	−0.0025	0.235	−0.0066–0.0016
% Faculty time devoted to clinical practice	0.0033	0.187	−0.0016–0.0083
Number of peer-reviewed publications per faculty FTE	−0.014	0.532	−0.059–0.031
Program characteristics			
Total cost of the program to students	0.040	0.203	−0.022–0.10
Program expenses per student	0.048	0.146	−0.017–0.11
Program length	−0.17	0.173	−0.40–0.072
Time in didactic education	0.017	0.503	−0.033–0.068
Time in clinical education	−0.041	0.463	−0.15–0.068
Number of students	0.10	0.072	−0.0089–0.21
Year accredited	0.051	0.362	−0.059–0.16
Control variables			
Year			

Variable	Correlation coefficient	*p* value	95% CI
2012	−0.035	0.077	−0.074–0.0038
2013	−0.043	0.038*	−0.084–−0.0024
2014	−0.020	0.418	−0.070–0.029
2015	−0.035	0.170	−0.086–0.015
2016	−0.034	0.225	−0.088–0.021
2017	−0.034	0.272	−0.095–0.027
Degree			
DPT	0.056	0.341	−0.053–0.17
MPT	−0.073	0.324	−0.22–0.072
MS	−0.12	0.414	−0.42–0.17
MSPT	0.057	0.716	−0.25–0.37
Curriculum model			
Guide-based	0.14	0.493	−0.27–0.56
Hybrid	0.11	0.526	−0.24–0.47
Lifespan-based	−0.026	0.901	−0.44–0.39
Modified problem-based	0.087	0.651	−0.29–0.46
Systems-based	0.12	0.513	−0.24–0.48
Traditional	0.18	0.315	−0.18–0.55

References

2007–2008 Fact Sheet: Physical Therapist Education Programs. (2008). *Commission on Accreditation in Physical Therapy Education*. Retrieved January 2, 2020, from http://www.capteonline.org/uploadedFiles/CAPTEorg/About_CAPTE/Resources/Aggregate_Program_Data/Archived_Aggregate_Program_Data/CAPTEPTAggregateData_2008.pdf.

2017–2018 Physical Therapist Education Programs Fact Sheets: Aggregate Program Data. (2018). *Commission on Accreditation in Physical Therapy Education.* Retrieved January 2, 2020, from http://www.capteonline.org/uploadedFiles/CAPTEorg/About_CAPTE/Resources/Aggregate_Program_Data/Archived_Aggregate_Program_Data/CAPTE_2018PTAggregateData.pdf.

ACS demographic and housing estimates: 2018: ACS 1-Year Estimates Data Profiles. (2018). *United States Census Bureau.* Retrieved May 19, 2020, from https://data.census.gov/cedsci/table?q=Race%20and%20Ethnicity&t=Race%20and%20Ethnicity&hidePreview=false&tid=ACSDP1Y2018.DP05&vintage=2018.

Alger, J. R. (1997, October 7). *The role of faculty in achieving and retaining a diverse student population*. Paper presented at the AACRAO Policy Summit, Denver, CO. Retrieved January 2, 2020, from https://www.aaup.org/issues/diversity-affirmative-action/resources-diversity-and-affirmative-action/role-faculty-achieving-and-retaining-diverse-student-population.

Allen, D., & Wolniak, G. C. (2015, April). *Exploring the effects of tuition increases on racial/ethnic diversity at public colleges and universities*. Paper presented at the 2015 AERA Annual Meeting. Chicago, IL. Retrieved February 19, 2020, from http://www.aera.net/Portals/38/Newsroom%20-%20Recent%20Research/Exploring%20the%20Effects%20of%20Tuition%20Increases%20on%20Racial-Ethnic%20Diversity%20at.pdf.

Archibald, R. B., & Feldman, D. H. (2006). State higher education spending and the tax revolt. *The Journal of Higher Education, 77*(4), 618–644.

Astin, A. (1993). *What matters in college: Four critical years revisited*. San Francisco: Jossey-Bass.

Bensimon, E. M. (2007). The underestimated significance of practitioner knowledge in the scholarship of student success. *Review of Higher Education, 30*(4), 441–469.

Brambor, T., Clark, W. R., & Golder, M. (2006). Understanding interaction models: Improving empirical analyses. *Political Analysis, 14,* 63–82. https://doi.org/10.1093/pan/mpl014.

Cameron, A. C., & Trivedi, P. K. (2009). *Microeconometrics using stata* (Revised ed.). College Station: Stata Press.

Ching, C. D. (2013). *Why race?: Understanding the importance of foregrounding race and ethnicity in achieving equality on college campuses*. Center for Urban Education, Rossier School of Education, University of Southern California, Los Angeles, CA.

Cook, C. (2017). 20th Pauline Cerasoli Lecture: The sunk cost fallacy. *Journal of Physical Therapy Education, 31*(3), 10–14.

Cook, C., Engelhard, C., Landry, M. D., & McCallum, C. (2015). Modifiable variables in physical therapy education programs associated with first-time and three-year National Physical Therapy Examination pass rates in the United States. *Journal of Educational Evaluation for Health Professions*, *12*(44). https://doi.org/10.3352/jeehp.2015.12.44.

Covington, K., McCallum, C., Engelhard, C., Landry, M. D., & Cook, C. (2016). Do differences in programmatic resource investments result in different 3-year pass rates on the U.S. National Physical Therapy Examination? *Journal of Allied Health, 45*(1), 27–32.

Dickson, T., Chen, P. D., & Taylor, B. (2019). Impact of funding allocation on physical therapist research productivity and DPT student graduates: An analysis using panel data. *Advances in Health Sciences Education: Theory and Practice, 24*(2), 269–285. https://doi.org/10.1007/s10459-018-9864-8.

Dickson, T., & Taylor, B. (2019). Factors that predict institutional adoption of professional physical therapy programs. *Physical Therapy, 99*(7), 849–861. https://doi.org/10.1093/ptj/pzz047.

Dickson, T., Taylor, B., & Zafereo, J. (In Press). Professional physical therapy faculty and program characteristics from 2008–2017: Influences on graduation rates and first-time NPTE pass rates. *Physical Therapy*.

Gasman, M., Kim, J., & Nguyen, T. H. (2011). Effectively recruiting faculty of color at highly selective institutions: A school of education case study. *Journal of Diversity in Higher Education, 4*(4), 212–222.

Hausman Specification Test. (2016). *Stata manual.* Retrieved January 2, 2020, from http://www.stata.com/manuals13/rhausman.pdf.

Huang, Y., Cantwell, B., & Taylor, B. J. (2016). Reasons for becoming a postdoc: Differences by race and foreign-born status. *Teachers College Record, 118,* 1–29.

Jack, A. A. (2019). *The privileged poor: How elite colleges are failing disadvantaged students*. Cambridge: Harvard University Press.

Jackson, C. S., & Gracia, J. N. (2014). Addressing health and health-care disparities: The role of a diverse workforce and the social determinants of health. *Nursing in 3D: Diversity, Disparities, and Social Determinants, 129*(2), 57–61.

Jewell, D. V., & Riddle, D. L. (2005). A method for predicting a students' risk for academic probation in a professional program in allied health. *Journal of Allied Health, 34*(1), 17–23.

Kezar, A., & Sam, C. (2010). Understanding the new majority of non-tenure-track faculty in higher education: Demographics, experiences, and plans of action. *ASHE Higher Education Series, 36*(4), 1–133.

Littler, J. (2013). Meritocracy as plutocracy: The marketising of 'equality' within neoliberalism. *New Formations: A Journal of Culture/Theory/Politics, 80–81,* 52–72. https://doi.org/10.3898/NewF.80/81.03.2013.

Littler, J. (2018). *Against meritocracy: Culture, power, and myths of mobility*. New York: Routledge.

Mayhew, J. M., Rockenbach, A. N., Bowman, N. A., Seifert, T. A., Wolniak, G. C., Pascarella, E. T., et al. (2016). *How college affects students: 21st century evidence that higher education works* (Vol. 3). San Francisco: Jossey-Bass Publications.

Melguizo, T. (2008). Quality matters: Assessing the impact of attending more selective institutions on college completion rates of minorities. *Research in Higher Education, 49,* 214–236.

Physical Therapist Member Demographic Profile. (2013). *American Physical Therapy Association.* Retrieved Jun 13, 2018, from http://www.apta.org/WorkforceData/DemographicProfile/PTMember/.

Price, S. S., & Grant-Mills, D. (2010). Effective admissions practices to achieve greater student diversity in dental schools. *Journal of Dental Education, 74*(1), s87–s97.

Rhoades, G., & Slaughter, S. (1997). Academic capitalism, managed professionals, and supply-side higher education. *Social Text, 51,* 9–38.

Riddle, D. L., Utzman, R. R., Jewell, D. V., Pearson, S., & Kong, X. (2009). Academic difficulty and program-level variables predict performance on the national physical therapy examination for licensure: A population-based cohort study. *Physical Therapy, 89*(11), 1182–1191. https://doi.org/10.2522/ptj/20080400.

Rogers, M. R., & Molina, L. E. (2006). Exemplary efforts in psychology to recruit and retain graduate students of color. *American Psychologist, 61*(2), 143–156.

Smedley, B. D., Stith, A. Y., & Nelson, A. R. (Eds.). (2003). *Unequal treatment: confronting racial and ethnic disparities in health care*. Institute of Medicine, Committee on Understanding and Eliminating Racial and Ethnic Disparities in Health Care, Board on Health Sciences Policy. Washington: National Academies Press.

Standards and Required Elements for Accreditation of Physical Therapist Education Programs. (2017). *Commission on Accreditation in Physical Therapy Education*. Retrieved August 22, 2019, from http://www.capteonline.org/uploadedFiles/CAPTEorg/About_CAPTE/Resources/Accreditation_Handbook/CAPTE_PTStandardsEvidence.pdf.

StataCorp. (2015). *Stata statistical software: Release 14*. College Station: StataCorp LP.

Taylor, B. J. (2016). The field dynamics of stratification among US research universities: The expansion of federal support for academic research, 2000–2008. In S. Slaughter, & B. J. Taylor (Eds.), *Higher education, stratification, and workforce development* (pp. 59–79). https://doi.org/10.1007/978-3-319-21512-9_4.

Taylor, B. J., & Cantwell, B. (2019). *Unequal higher education: Wealth, status, and student opportunity*. New Brunswick: Rutgers University Press.

The Carnegie classification of institutions of higher education. (2015). *Basic classification description.* Retrieved January 2, 2020, from https://carnegieclassifications.iu.edu/classification_descriptions/basic.php.

Tierney, W. G., & Sallee, M. W. (2008). Do organizational structure and strategies increase faculty diversity: A cultural analysis. *American Academic, 4,* 159–184.

Tight, M. (2013). Students: customers, clients, or pawns? *Higher Education Policy, 26,* 291–307.

Toutkoushian, R. K. (2001). Trends in revenues and expenditures for public and private higher education. In M. B. Paulsen & J. C. Smart (Eds.), *The finance of higher education* (pp. 11–38). New York: Agathon Press.

Turner, C. S. V., Gonzales, J. C., & Wood, J. L. (2008). Faculty of color in academe: What 20 years of literature tells us. *Journal of Diversity in Higher Education, 1*(3), 139–168.

Utzman, R. R., Riddle, D. L., & Jewell, D. V. (2007). Use of demographic and quantitative admissions data to predict academic difficulty among professional physical therapist students. *Physical Therapy, 87*(9), 1164–1180.

Veal, K., Perry, M., Stavisky, J., & Herbert, K. D. (2004). The pathway to dentistry for minority students: From their perspective. *Journal of Dental Education, 68*(9), 938–946.

Wilcox, K. C., Weber, M., & Andrew, D. L. (2005). Factors influencing minority students' choice of physical therapist education programs. *Journal of Physical Therapy Education, 19*(2), 8–14.

Zhang, L. (2010). The use of panel data models in higher education policy studies. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 25, pp. 307–350). New York: Springer.

Zhang, L., & Ehrenberg, R. G. (2010). Faculty employment and R&D expenditures at research universities. *Economics of Education Review, 29,* 329–337.