Livin' on a prayer:

A quasi-experimental investigation into the efficacy of learning communities

Kevin Fosnacht

Polly A. Graham

Indiana University Center for Postsecondary Research

Corresponding author:

Kevin Fosnacht

Indiana University Center for Postsecondary Research

1900 East Tenth St., Suite 419, Bloomington, IN 47406

kfosnach@indiana.edu

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Abstract

With the increasing adoption of learning communities by post-secondary institutions, it is imperative to document their effectiveness, as the existing research is not definitive. In this study, we found that learning communities have a positive impact on students’ engagement and perceived gains using a quasi-experimental approach, confirming previous research; however, learning communities do not appear to drastically alter the student experience on average. Additionally, we found that the estimated effect of learning communities varies widely across institutions on a variety of measures. Consequently, it appears that while some learning communities are extremely impactful, others have a negligible impact on students.

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Concerns about collegiate quality are nearly as old as American higher education itself (Thelin, 2011). In the not too distant past, concerns are about quality were communicated through reports such as *A Nation at Risk: The Imperative for Educational Reform* (1983); *Involvement in Learning: Realizing the Potential of American Higher Education* (1984); and *Integrity in the Curriculum: Report to the Academic Community* (1985) (Association of American Colleges, 1985; National Institute of Education, 1984; Smith, MacGregor, Matthews & Gabelnick, 2004; Tinto, 2003; U.S. Department of Education, 1983). These reports called the higher education community to reconsider the current state of affairs in higher education, as declining test scores, lowered international comparisons of student achievement, inequitable access, and high dropout rates pointed to the many problems in the higher education system. As one of the means of redressing these problems, the 1990s saw a revival in the interest in learning communities. Learning communities—emphasizing social connections, academic cohesion, and high levels of engagement—were prime candidates for addressing concerns of collegiate quality (Brown & Minnick, 2005; Fink & Inkelas, 2015; Kuh, 2008; Shapiro & Levine, 1999; Smith, MacGregor, Matthews & Gabelnick, 2004). Over the past 25 years there has been a sustained interest in learning communities, with hundreds of institutions across the country utilizing them in their educational programming (Laufgraben & Shapiro, 2004; Smith, MacGregor, Matthews & Gabelnick, 2004).

Learning communities ongoing appeal is not surprising given their association with a host of positive outcomes, such as persistence and retention (Gebauer, Watterson, Malm, Filling-

Brown, & Cordes, 2013; Hill & Woodward, 2013; Johnson, 2000), increased faculty-student interaction (Pike, 1999; Zhao & Kuh, 2004), and higher grades (Stassen, 2003). As higher education rhetoric shifts to focus beyond access to success and completion, acknowledging that degree attainment is critical for the actualization of the goods associated with college (Alderman, 2007; Engstrom & Tinto, 2008), learning communities are promising interventions. The focus on student success is of much consequence as students who do not persist are often burdened with debt and face bleak forecasts for their earning power (Nguyen, 2012). In other words, it can be worse for a student financially to start college and drop out than to not have attended at all.

In order to address prevailing concerns about completion and student learning, higher education administrators have focused efforts on developing programs and policies that foster success for students of all backgrounds and identities. Increasing focus has been placed on practices found to enhance student learning and success and these have been identified as high-impact practices, or by the abbreviation of HIPs (AAC&U, 2007; Kuh, 2008). HIPs are believed to be effective as they require high levels of time and effort, investment, and commitment to college (Kuh, 2008). Practices identified as HIPs include learning communities, service learning, study abroad, student-faculty research, and culminating senior experiences (Kuh, 2008). Learning communities were specifically labelled a HIP due to their positive association with a host of outcomes, i.e., deep learning, academic challenge, active and collaborative learning, student-faculty interaction, and supportive campus environment as well as reported general, personal, and practical gains (Kuh, 2008). Kuh, O'Donnell, and Reed (2013) reevaluated HIPs, and the benefits of participation in learning communities were reaffirmed as participants exhibited comparatively higher engagement levels and other self-reported gains.

While many researchers and practitioners have highlighted the benefits of participating in a learning community, research examining the causality of learning communities is lacking. To date, no studies focusing on the effects of learning communities on students enrolled at bachelor's-granting institutions have met the Institute of Education Sciences' standards for high quality research (U.S. Department of Education, 2014a, 2014b). The research meeting this standard focuses on community colleges and demonstrates non-substantial impacts on students (U.S. Department of Education, 2014a, 2014b). This lack of demonstrated efficacy is troubling given the proliferation of learning communities and the need to prioritize higher education's resources to maximize their impact on students' learning and development. Consequently, this study seeks to fill in this literature gap by using a quasi-experimental technique to assess the relationship between learning communities and first-year students' engagement and perceived gains with a multi-institutional sample. Furthermore, it examines how the estimated effects of learning communities varies across institutions.

Previous Literature

Studying learning communities has been difficult for researchers as they have varied forms and designs. Love (2012) states that learning communities are "associated with an intentional restructuring of the curriculum and student course-taking patterns to emphasize an interdisciplinary focus with attention paid to students' academic and social development" (p. 7). More broadly speaking, learning communities are intentionally formed groups of students and faculty with the goal of maximizing learning (Lenning & Ebbers, 1999). One conspicuous difference among learning communities is whether or not the learning community includes a residential component.

There have been attempts at creating typologies to categorize learning communities,

including Lenning and Ebbers (1999) four classifications of student learning communities that examined the following dimensions: (1) curricular, (2) classroom, (3) residential, and (4) student-type. Lenning and Ebber's (1999) classifications draw attention to the scope of learning communities, as they include the small-scale group of students learning together in a classroom to the more intense community of students living and learning together in a residence hall. A more recent typology was created by Inkelas, Soldner, Longerbeam, and Leonard's (2008) that evaluated the structure of programs on their size, collaborations, and resources. Inkelas, Soldner, Longerbeam and Leonard's typology incorporated less investigated aspects of learning communities, including budgetary oversight, faculty involvement, curricular decisions, etc., focusing more on learning communities' organization than had previous studies. In sum, these classification systems highlight the wide variation of learning communities across the higher education system.

The Washington Center, a national resource center for learning communities, attempts to delimit the wide-range of practices designated as "learning communities" by putting forward three minimum standards: (1) "a strategically-defined cohort of students taking courses together which have been identified through a review of institutional data, (2) robust, collaborative partnerships between academic affairs and student affairs, and, (3) explicitly designed opportunities to practice integrative and interdisciplinary learning" (Washington Center, n.d., para. 4). However, the literature reveals this definition to be more of an ideal than a standard (Cross, 1998; Kuh, 2008).

Keeping in mind the broad scope of learning communities, research from the past twenty-five years has, for the most part, confirmed their benefits. For example, using data from the National Survey of Student Engagement (NSSE), Zhao & Kuh (2004) found that participation in

learning communities, defined as "a formal program where groups of students take two or more classes together, and may or may not have a residential component" (p. 119) was positively related to academic performance, student engagement in educationally purposeful activities, college attendance, and satisfaction. Moreover, Soldner et al. (2012) found learning community programs were positively associated with STEM students' quality of peer and faculty interactions. Similarly, a study of Cerritos College students found learning community participants reported positive interactions with faculty and peers as well as benefits in understanding and retaining course material (Smartt-Gaither, 1999). Along with strengthened interactions, increases in student satisfaction have been regularly correlated with participation in learning communities (Lenning & Ebbers, 1999; Ericksen & Walker, 2015; Zhao & Kuh, 2004; Johnson & Romanoff, 1999).

Furthermore, two important indicators of student success—retention and persistence—have been shown to be positively related to learning community participation (Johnson, 2000; Gebauer, Watterson, Malm, Filling-Brown, Cordes, 2013; Hill & Woodward, 2013), especially for participants from underserved populations (Nosaka & Novak, 2014; Ericksen & Walker, 2015; Huerta & Bray, 2013). As the rhetoric on higher education continues to call for looking beyond access to student success for marginalized or underserved populations, confirming the types of benefits associated with learning communities is important. Furthermore, if research continues to substantiate positive outcomes associated with learning community participation for marginalized populations, Kuh's (2013) finding that certain groups of students participate at proportionately lower rates is especially concerning.

Although there is a great deal of literature highlighting the benefits of learning communities, some research calls into question their uniform positive effects for all types of

students. Heaney & Fisher (2011) found that while research has demonstrated that learning communities engender high social integration, the relationship varies across student types. Their results indicate that students who struggled with social adaptation and homesickness did not experience the positive effects of learning communities at the same rates as their peers. Additionally, Jaffee (2007) points out that although the benefits of learning communities are often touted, "positive outcomes are a contingent rather than automatic result of FLC [freshman learning community] programs" (p. 66). Jaffee found that learning communities unintentionally foster conditions that delay academic development, precipitating regressive behavior conformity, inciting role conflict, and encouraging groupthink among other negative outcomes. Thus, a better understanding of learning communities' efficacy is needed.

While most research supports the efficacy of learning communities on student outcomes, the relationships examined have been exclusively correlational when examining the experiences of students at bachelor's degree-granting institutions. The need to improve the research on learning communities is emphasized by the Institute of Education Sciences' What Works Clearinghouse (U.S. Department of Education, 2014a; U.S. Department of Education, 2014b) review of the literature on learning communities. As of 2014, no studies examining residential learning communities designed for four-year institutions have met their standards for high-quality research (U.S. Department of Education, 2014a). Additionally, the research meeting their standards for linked-learning communities focuses only on community college students and demonstrated no discernable effects on outcomes such as academic achievement and degree attainment (U.S. Department of Education, 2014b). Therefore, our research paper will address this literature gap by using a quasi-experimental design to identify the impacts of learning community participation on the engagement of first-time, first-year undergraduates at four-year

institutions. Additionally, we will also investigate if the estimated impacts of learning communities vary across institutions.

Theory

Our study is guided by social capital and student engagement theory. Both theories offer cogent explanations as to why learning communities are positioned to bring about positive outcomes. While the theories are associated with different disciplines the theories can be understood as complimentary. Student engagement theory argues that the quality and quantity of students' effort as well as institutional efforts matter to student success, while social capital theory asserts that social networks and the corresponding trust developed among individuals within the social network delimits opportunities (Halpern, 2005). Learning communities are constructed in ways that are likely to foster positive student and institutional efforts as well as increase advantageous social connections.

The concept of engagement can be traced back nearly a century to the work of Ralph Tyler (1932), but it owes its current form to the work of various higher education theorists, including Pace (1980), Astin (1984), Chickering and Gamson (1987), and Kuh et al. (1991). Although investigating a similar construct, each of these theorists had a slightly different emphasis and terminology. Pace (1980) emphasized effort; Astin's (1984) focus was involvement; Chickering and Gamson (1987) stressed interactions, and Kuh et al. (1991) foregrounded institutional environment and the co-curricular.

Astin (1984) defines involvement as the "amount of physical and psychological energy that the student devotes to the academic experience" (p. 518). As Wolf-Wendel, Ward and Kinzie (2009) point out, the unit of analysis in Astin's work is the individual. It is the individual who determines her level of involvement. Alternatively, student engagement theory emphasizes

both students' time and effort as well as institutional efforts to support students' learning and development. Therefore, engagement goes beyond involvement as it takes into account not only student efforts, but also institutional policies and practices that to contribute to student success (Kuh, 2005). Institutional efforts include creating a climate that enables, programs that encourage, and a curriculum that promotes student learning and development. Learning communities are programs designed by institutions to foster student engagement in- and out-side of the classroom. According to the theory of engagement, learning communities enhance the likelihood for students to succeed through the intentional time and effort expended by both students and institutions.

The history of social capital theory is long and involved. Halpern (2005) attributes a range of thinkers to its development, including the philosopher and economist Adam Smith, the pioneering sociologist Émile Durkheim, and, more recently Pierre Bourdieu and Robert Putnam. As is often the case with widely used concepts, social capital theory is not uniformly applied nor defined. However, Halpern (2005) offers three generally agreed upon tenets of social capital: (1) includes a network; (2) includes shared norms, values, and expectations; and (3) includes sanctions, that is, positive or negative consequences for behavior in maintenance of the status quo. The potential power of social capital comes from access to power and resources (financial, human, material, etc.) that is brought about as result of the social groups to which one belongs. Learning communities, "intentionally reorganize courses or restructure the curriculum completely so that students, together with their peers and teachers, can build more meaningful connections to each other and what they are learning" (Shapiro & Levine, 1999, p. 16). Social capital contends that connections such as the ones fostered in learning communities engender reciprocity and trust among individuals. As social beings, both are personal well-being and our

professional success is influenced by the people with whom we spend time and build relationships. Learning communities, as is evident even from its name, are structured to build community and thereby enhance the social capital of participants.

Research Questions

While much research has correlated learning community participation with positive student outcomes, rigorous research into the effects of learning communities is sparse, particularly for bachelor's-seeking students. Therefore, we attempted to partially fill this knowledge gap by conducting a quasi-experimental investigation into the link between learning communities and student engagement. In particular, we focused on the first-year experience for a multi-institutional sample of students attending bachelor's-granting institutions. The research questions guiding this inquiry were:

1. What is the relationship between learning community participation and student engagement and self-perceived gains for bachelor's-seeking first-year students?
2. To what extent does the relationship between learning communities and the aforementioned outcomes vary between institutions?

Methods

Data

To answer these research questions, we utilized a sample of full-time, first-year students who responded to the 2013 administration of the Beginning College Survey of Student Engagement (BCSSE) and 2014 administration of the National Survey of Student Engagement (NSSE). BCSSE is a survey administered during orientation or prior to enrollment that examines first-year students' high school experiences and college expectations. In contrast, NSSE in the winter during the academic year on focuses on students' college experiences and is typically

administered to first-year and senior students. We excluded from our sample students who attended a special-focus institution (e.g., seminaries, conservatories, and engineering schools) due to the specialized nature of these institutions. Due to our focus on learning communities, we eliminated students from our sample who attended institutions where less than 5% of the respondents indicated they participated in learning community. Additionally, we removed international students from our dataset as many learning communities are designed for and targeted at domestic students.

After accounting for these exclusions, our sample included 9,986 students who attended 83 institutions. 17 percent of the sample participated in a learning community. Seven out of 10 students sampled were females. 75 percent of the students identified as White, with Asians, African Americans, and Hispanic/Latinos each comprised 5% of the sample. The remaining students were multi-racial/ethnic or were classified as "Other". About a third of the students were first-generation. A quarter of the sample attended doctoral universities, 44% were enrolled in master's colleges and universities, while the remaining students attended baccalaureate colleges.

Our primary outcome variables were the 10 NSSE Engagement Indicators and students' Perceived Gains. The Engagement Indicators were introduced in conjunction with the updated NSSE in 2013 and are summary measures of student engagement across four broad domains: academic challenge, learning with peers, experiences with faculty, and the campus environment. The Cronbach's α of the Engagement Indicators range from .76 to .89, with all but one in excess of .80 (National Survey of Student Engagement, 2014). The Perceived Gains index is a composite of 12 items inquiring about how students' college experience improved their knowledge, skills, and personal development. The Cronbach's α for Perceived Gains was .90. All

of these variables were standardized with a mean of 0 and standard deviation of 1 to allow for the efficient estimation of effect sizes by learning community participation. Our other key variable was learning community participation. Students who indicated they participated or were currently involved in a "learning community or some other formal program where groups of students take two or more classes together" were coded as having participated in a learning community. All other students were coded as not having participated in a learning community.

We also utilized a variety of data on students' characteristics, high school experiences, and expectations for college. Our data on students' sex and race were reported by their institutions, while all other data was self-reported by students on BCSSE and NSSE. The other student characteristics used in the analyses included high school grades, parental education, standardized test score (SAT/ACT), anticipated major field, distance from home to college, and the number friends attending the same college. The high school experience variables included BCSSE scales on high school engagement in quantitative reasoning and learning strategies, time spent preparing for class, participating in co-curricular activities, and relaxing and socializing, and the extent to which their courses challenged them. Additionally, variables on students' involvement in performing or visual arts programs, athletic teams, student government, publications, vocational clubs, and volunteering were utilized. Finally, data on the following BCSSE scales were used to account for students' college expectations: expected engagement in collaborative learning, with faculty, and with diverse others, expected academic perseverance, expected academic difficulty, perceived academic preparation, and importance of the campus environment. For results on the validity and reliability of the BCSSE scales, see Cole and Dong (n.d.).

Our theoretical framework guided our selection in these variables, which was particularly important due to the lack of previous research indicating which students participate in learning communities. In addition to focusing on common demographic characteristics, we selected variables like the number of friends also attending the same college to indicate the power of social networks in distributing information on the possibility and value of participating in a learning community. Similarly, we included variables on high school experiences and major choice to represent students' interest in activities or topics that may form the basis of learning community like community service or the sciences.

We utilized multiple imputation by chained equations (MICE) to impute missing data (Raghunathan, Lepkowski, Van Hoewyk, & Solenberger, 2001; Rubin, 1987). MICE uses a series of regression models to impute missing data and allows for each variable to be modeled according to its distribution. A total of 20 imputed datasets were created to minimize the loss of statistical power, while keeping the time to run the imputation and analytic models reasonable (Graham, Olchowski, & Gilreath, 2007). Continuous variables were imputed using predictive mean matching. Binary, ordinal, and nominal variables were imputed using the appropriate form of logistic regression.

Analyses

In keeping with our desire to use a more robust method to assess the impacts of learning communities on student engagement, we utilized a propensity score framework to guide our analyses. The framework seeks to create a counterfactual, an alternative state where an individual is exposed to a different treatment assignment, which allows for the estimation of causal inferences. As it is commonly unethical or impractical for researchers to randomly assign students to different treatments, propensity scores allow for researchers to compare the outcomes

for students with the same or very similar latent probabilities of receiving a treatment or in the case of this study participating in a learning community.

Propensity score analyses require the researchers to preprocess the data by first estimating students' probability of participating in a treatment (learning community). Therefore, we created a random-intercept logistic regression model, with school-specific random intercepts, to estimate students' probability of participating in a learning community using the variables described above. The random intercept term allows for the model to account for school-specific probabilities of participating in a learning community.

Next, we used the model to predict students' individual probability of participating in a learning community. The probabilities were used to create inverse probabilities weights which would allow us to estimate treatment-on-treated (TOT) effects. The weights were created using the following formula created by Hirano, Imbens, and Ridder (2003):

$$\omega_{ij} = T_{ij} + (1 - T_{ij})\left(\frac{p_{ij}}{1-p_{ij}}\right) \qquad (1)$$

Where,
ω_{ij} is the weight for individual *i* in school *j*

T_{ij} is the treatment assignment (learning community participation) for individual *I* in school *j*

p_{ij} is the estimated probability of receiving the treatment for individual *i* in school *j*.
In this formula, participants receive a weight of 1, while the weight for non-participants varies according to their latent probability of participating

Then, we checked to ensure that the participants had equivalent means and distributions on the variables used to predict learning community participation. Using the weights created in equation 2, we performed two tests suggested by Rubin (2001). The first test checked to see if the participants and non-participants had equivalent means. This was done by checking to see if the absolute standardized difference for each variable was between 0 and .25. The second test

compared the compared the standard deviations for each variable and checked to see if they ranged between .5 and 2.

After pre-processing the data and ensuring that the sample had equivalent characteristics among the participants and non-participants, we created a series of models to estimate the influence of learning community participation on student engagement and students' perceived gains to answer research question 1. The first two models were unweighted and regressed learning community participation status on each of the outcome variables without and with controlling for other characteristics. The next two models repeated these analyses, but employed the inverse probability weights created through equation 2. Then, we estimated the relationships using a random-intercept model with school-specific intercepts that also controlled for other student characteristics while also using the inverse probability weights. Our final analysis sought to answer our second research question and focused upon the variability in the association between learning communities and the outcomes across institutions. This was assessed using random coefficient models with varying intercept and slope parameters. As the estimates for the propensity-weighted models were highly consistent across the models, the random coefficient models did not employ control variables, but did utilize the inverse propensity weights, to reduce the computational time.

Due to our use of multiple imputation, all results are the average of the estimates from the 20 imputed datasets. Standard errors were adjusted to account for the uncertainty of the imputation according to Rubin's (1987) rules for multiple imputation and the nesting of students within schools. All analyses were performed using Stata 14 (StataCorp, 2016).

Limitations

Prior to presenting the results, we need to acknowledge the study's limitations. The main limitations revolve around the assumptions of the propensity score methodology. First is the Stable Unit Treatment Value Assumption which assumes that the treatment status does not affect the status another and the treatments are comparable. Thus, the variations in the implementation of learning community programs may bias our results. Second, the assumption of ignitability assumes that all variables related to learning community participation are included in the propensity score (selection) model. While we included a wide variety of variables and nearly all available data in our model predicting learning community, due to the lack of literature in this area, we may have omitted important variables related to learning community participation.

Results

Prior to estimating the relationship between learning community participation and our outcome variables, we first created a model predicting learning community participation in accordance with the propensity score framework outlined above. The results from the regression model for learning community participation can be found in Appendix A. We then used the results from this model to create inverse probability weights and assessed our sample's balance with and without employing the weights. Prior to weighting, the mean of the absolute standardized differences of the variables used to in the propensity score model by learning community participation status was .06. The range of the absolute standardized differences was .003 to .195, while the standard deviation ratios ranged from .82 to 1.27. When the sample was weighted, the mean absolute standardized difference was .02, with a range of less than .001 to .096. The range of the standard deviation ratios was .85 to 1.09. Consequently, we concluded that there were minimal differences in the observable characteristics between participants and

non-participants and their distribution after weighting. The full results from the balance testing are available in Appendix B.

After concluding that our sample met the balancing assumptions of the propensity score model, we ran a series of models to investigate the link between learning community participation and our outcome variables. The results from these analyses are summarized in Table 1. The first model in Table 1 displays the effect size differences between students who did and did not participate in learning communities without weighting for the probability of participating or controlling for other factors. All of these differences were significant and ranged from a low of .07 SDs for Effective Teaching Practices to a high of .39 SDs for Student-Faculty Interaction.

The results for models 2, 3 and 4 were nearly identical. All of the estimated treatment effects were significant, except for Effective Teaching Practices. When categorized by size, the estimated effects for Reflective & Integrative Learning, Collaborative Learning, and Student-Faculty Interaction were all roughly .20 SDs or higher. The estimated differences for the remaining seven outcome variables all were approximately between .10 and .19 SDs.

Next, we investigated the extent to which the relationship between learning community participation and our dependent variables varied across institutions using random-coefficient models. The results from these models are visually displayed in Figure 1. The dark boxes represent the estimated population-mean effect sizes plus or minus one standard deviation of the estimated random coefficient for learning community participation. Thus, we would expect the estimated effects of learning communities at two out of three schools to fall within the black boxes. The grey lines extend out to plus or minus 2 standard deviations and we would expect about 95% of the estimated effects to be within this range. Virtually no variability in the

estimated effects between institutions was found for the following outcomes: learning strategies, collaborative learning, quality of interactions, and perceived gains. Thus, the relationship between learning community participation and these outcomes appears to be very consistent across institutions. More variance in the relationship across institutions was observed for effective teaching practices; however, it was not substantial. In contrast, the range from the high to low effect size estimates was .33 SDs or higher for higher-order learning, reflective and integrative learning, quantitative reasoning, student-faculty interaction, and supportive environment. Therefore, the effect of learning communities appears to substantially differ across institutions for these outcomes.

Discussion

For many decades, the higher education research community has been searching for a silver bullet to improve student learning and persistence through graduation. However, despite the substantial efforts by dedicated researchers, no single program or policy has been discovered to be a panacea to improve the effectiveness of higher education. Yet, these efforts have not been in vain. In particular, researchers have associated a number of programs and institutional practices, subsequently labeled as High Impact Practices (HIPs), with improvements in student learning and development. While there has been much correlational research examining HIPs, scant research has been disseminated using experimental or quasi-experimental methods to more conclusively link HIPs to student learning and development. Thus, higher education institutions may be misallocating their scarce resources to programs that have not been conclusively documented to be effective.

In this paper, we examined the efficacy of one HIP, learning communities, on students' engagement and perceived gains using propensity score analysis, a quasi-experimental technique.

In addition to estimating the population average effect of learning community participation in our sample of approximately 10,000 first-year students attending 83 bachelor's-granting institutions, we harnessed the multi-institutional nature of our sample to examine how the effects of learning communities vary by institution. Our quasi-experimental results generally comport with previous correlational research on the programs. On average, we estimated that learning communities have a significant and positive effect on multiple facets of student engagement and students' self-perceived gains (see Table 1). The lone exception occurred for Effective Teaching Practices, as learning community participation was positively, but not significantly associated with this outcome. It is also important to note that our sample, after weighting for the probability of participation, had equivalent characteristics by learning community participation status, which allows us to assert with greater confidence the efficacy of learning communities than previous studies examining bachelor's-seeking students.

While we found mostly significant differences in our outcomes by learning community participation, learning community participation does not appear to have an equivalent impact across the various domains of student engagement examined. In particular, our results show that learning communities have the largest effects on student-faculty interaction, reflective and integrative learning, and collaborative learning. The results for the latter two outcomes are less surprising as learning communities are designed to pair students and integrate coursework. However, the increase in student-faculty interaction is more surprising, particularly due to the lack of a relationship on effective teaching practices. Thus, learning communities appear to alter students' relationships with professors outside of the classroom without a corresponding increase in effective teaching practices inside the classroom.

While learning communities appear to be effective, they do not appear to drastically alter the student experience. A study of effect sizes in the NSSE Engagement Indicators recommends classifying effects sizes smaller than .10 as trivial, .10 to .29 as small, .30 to .49 as medium, and .50 or above as large (Rocconi & Gonyea, 2015). Except for the Effective Teaching Practices estimates, nearly all of our effect size estimates were between .10 and .29 and thus should be classified as small.

While the above results reflect the population average effect of learning communities, we found substantial variation in the estimated effects by institution in 5 of our 11 dependent variables. In particular, the estimates for higher-order learning, reflective & integrative learning, quantitative reasoning, student-faculty interaction, and supportive environment ranged from trivial for institutions with the least impactful programs to medium or large for the most impactful institutions. Consequently, the effects of learning communities on students' experiences appear to vary substantially. This finding suggests that the nature and structure of a learning community is linked with its effectiveness and that simply implementing a learning community program will not automatically improve all facets of students' learning and development. However, the estimates on collaborative learning, perceived gains, discussions with diverse others and learning strategies were highly consistent across schools and non-trivial. Therefore, we conclude that learning communities' basic feature of having a cohort of students attending the same courses together appears to be an effective approach to promoting these types of student engagement and perceived gains.

Unfortunately, specific information on the costs of implementing learning communities is not widely discussed in the available literature, with the lone mention about two decades old (Johnson, 2000). Consequently, we are unable to conduct a cost-benefit analysis on the effects of

learning communities. Furthermore, the variation in the effects estimated indicates that the results from a cost-benefit analysis would vary greatly across institutions. However, we can speculate that the most effective programs probably represent a strong value for the resources required to operate. The cost-benefit equation is less clear for less effective programs. The less effective programs that operate inexpensively probably represent a decent value for their financial inputs, but institutions operating more expensive programs requiring substantial staff and promotional resources may be better off restructuring their programs or placing their resources elsewhere.

Implications for research

This study attempted to provide more concrete evidence for the effectiveness of learning communities. Our results comport with previous research on learning communities, which validates others' findings that learning communities are an important tool for improving student learning and success. However, we also discovered that all learning communities are not created equal. Thus, the natural follow-up question is which types of learning communities are most effective and why. In addition to answering this vital question, research should also focus upon how the effects of learning communities vary by different student populations (e.g., race/ethnicity, gender, socio-economic status).

Implications for practice

Our study corroborates previous research that learning communities are effective means in addressing student learning and success. However, practitioners must take into the account the variance among learning communities as well as the relatively small effect sizes and have realistic expectations. In other words, there are better and worse learning communities and even the best ones will not in and of themselves totally solve student success concerns. This

understanding should inform resource allocation decisions and encourage decision-makers to thoughtfully develop or sustain learning communities on their campuses. Additionally, our research suggests that learning communities will not address pedagogical issues. While learning communities are able to foster higher levels of integrative learning and faculty-student interaction, ineffective programming and practices can still persist within learning communities. Thus, faculty participating in learning communities may benefit from teaching centers or other resources that seek to develop effective teaching practices.

Conclusion

With the increasing adoption of learning communities by post-secondary institutions to improve student learning and development, it is imperative to document the effectiveness of learning communities. In this study, we found that learning communities have a positive impact on students' engagement and perceived gains, confirming previous research; however, this effect does not drastically alter the student experience on average. Additionally, we found that the estimated effect of learning communities varies widely across institutions on a variety of measures. Consequently, it appears that while some learning communities are extremely impactful, others have a negligible impact on students.

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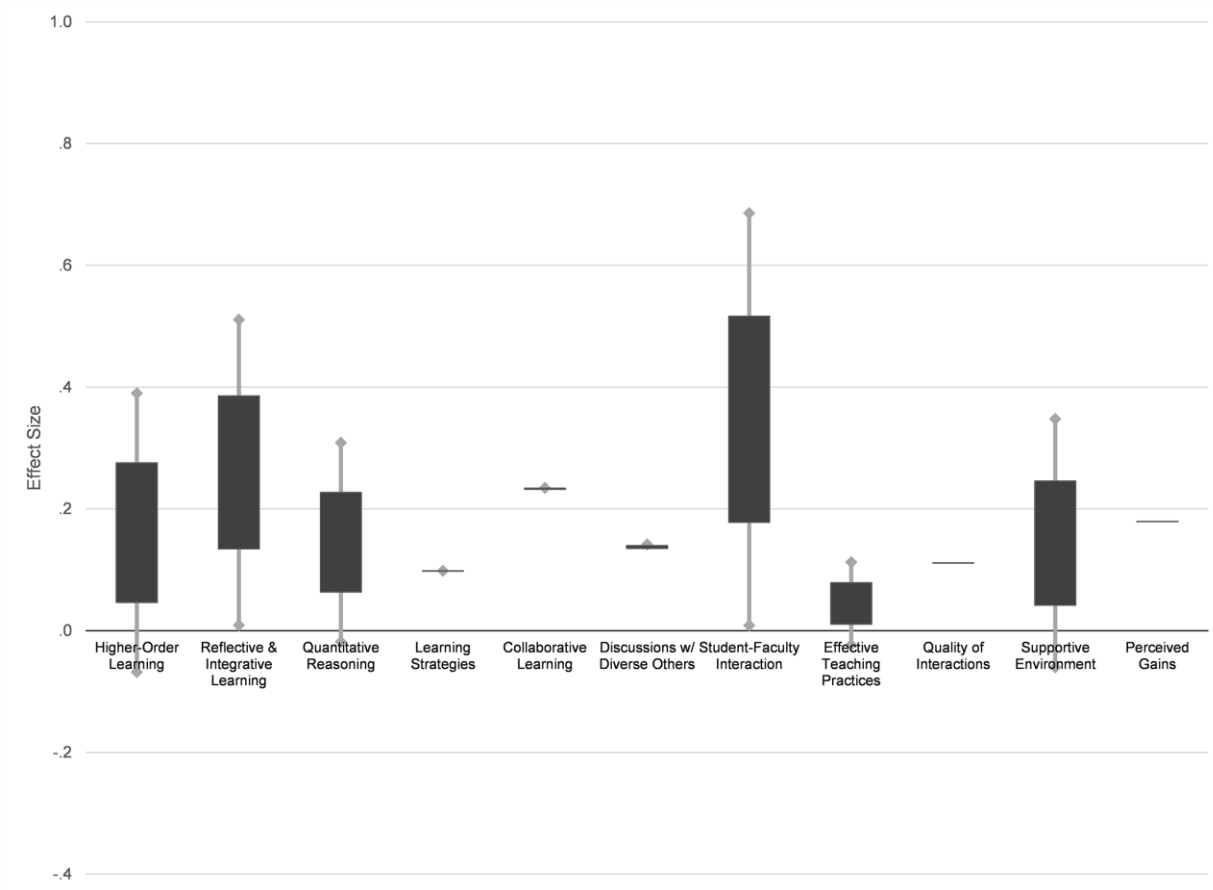
Table 1.
Treatment on treated effect size estimates of learning community participation

	Model 1		Model 2		Model 3		Model 4		Model 5	
Outcome	ES	Sig.	ES	Sig.	ES	Sig.	ES	Sig.	ES	Sig.
Higher-Order Learning	.26	***	.17	***	.15	***	.16	***	.15	***
Reflective & Integrative Learning	.35	***	.24	***	.22	***	.24	***	.25	***
Quantitative Reasoning	.19	***	.14	***	.13	***	.14	***	.15	***
Learning Strategies	.21	***	.11	***	.10	**	.11	***	.10	***
Collaborative Learning	.32	***	.22	***	.20	***	.22	***	.23	***
Discussions w/ Diverse Others	.20	***	.12	**	.10	**	.11	**	.14	***
Student-Faculty Interaction	.39	***	.29	***	.28	***	.29	***	.33	***
Effective Teaching Practices	.07	*	.04		.03		.04		.04	
Quality of Interactions	.15	***	.11	***	.09	**	.11	***	.11	***
Supportive Environment	.21	***	.14	***	.13	***	.14	***	.14	***
Perceived Gains	.25	***	.18	***	.17	***	.17	***	.18	***
Model Characteristics										
Propensity Weighted					X		X		X	
Controls			X				X			
Random Intercept									X	

*** p < .001, ** p < .01, * p < .05

Note: Results are the average from 20 imputed datasets. Standard errors were adjusted to account for the uncertainty of the imputation.

Figure 1.
Variability in the relationship between learning community participation and student engagement and perceived gains



Note: The black boxes represent the population average effect size ± 1 SD of the random coefficient. The grey bars represent the population average effect size ± 2 SDs of the random coefficient. Estimates are the average from 20 imputed datasets.

Appendix A.
Propensity score estimation model

	Est.	Sig.	Odds Ratio
Fixed Effects			
Male	-.22	**	.80
SAT/ACT (1,000s)	.00	**	1.00
Race/ethnicity (White)			
Asian	-.07		.93
Black	.13		1.14
Hispanic	-.12		.89
Multiracial	.07		1.07
Other	-.24		.79
Parental education (Less than HS)			
HS diploma/GED	.35		1.42
Some college	.30		1.34
Associate's	.28		1.32
Bachelor's	.36		1.44
Master's	.42		1.52
Doctoral/professional	.63	*	1.87
HS grades (Cs or lower)			1.00
As	-.38		.68
Bs	-.44		.65
Distance: home to college (<1 hr)			
1-2 hrs.	.16		1.17
2-4 hrs.	.05		1.05
4-6 hrs.	.19		1.21
6-8 hrs.	.28		1.33
>8 hrs.	.13		1.14
Friends attending the same college (None)			
1	-.08		.92
2	-.29	*	.75
3	-.20		.82
4 or more	-.12		.89
HS athletics involvement (Not at all)			
Very little	-.12		.89
Some	.10		1.11
Quite a bit	.19		1.21
Very much	-.04		.96

	Est.	Sig.	Odds Ratio
HS arts involvement (Not at all)			
Very little	-.12		.89
Some	.13		1.14
Quite a bit	.12		1.13
Very much	.11		1.12
HS vocational clubs involvement (Not at all)			
Very little	.04		1.04
Some	.03		1.03
Quite a bit	.35	*	1.42
Very much	.26	*	1.29
HS volunteering involvement (Not at all)			
Very little	-.02		.98
Some	.03		1.03
Quite a bit	.25		1.29
Very much	.30		1.35
HS stud. govt. involvement (Not at all)			
Very little	.13		1.13
Some	.15		1.16
Quite a bit	.28	*	1.32
Very much	.18		1.20
HS course challenge (Not at all - 1)			
2	.38		1.46
3	-.02		.98
4	.00		1.00
5	-.06		.95
6	-.05		.95
Very much - 7	.01		1.01
HS time co-curricular activities (0 HPW)			
1-5 HPW	-.05		.95
6-10 HPW	-.03		.97
11-15 HPW	.18		1.20
16-20 HPW	-.04		.96
21-25 HPW	.07		1.07
26-30 HPW	-.09		.91
> 30 HPW	.48	*	1.61

	Est.	Sig.	Odds Ratio
HS time preparing for class (0 HPW)			
1-5 HPW	.01		1.01
6-10 HPW	.08		1.08
11-15 HPW	.17		1.19
16-20 HPW	.04		1.04
21-25 HPW	.42		1.52
26-30 HPW	-.37		.69
> 30 HPW	.12		1.13
HS time relaxing and socializing (0 HPW)			
1-5 HPW	.38		1.46
6-10 HPW	.40		1.50
11-15 HPW	.22		1.24
16-20 HPW	.36		1.43
21-25 HPW	.13		1.14
26-30 HPW	.38		1.47
> 30 HPW	.22		1.24
Anticipated Major (Arts & Hums.)			
Bio. Sci.	.06		1.06
Phys. Sci.	-.36		.69
Soc. Sci.	.05		1.05
Business	.02		1.02
Comm.	.05		1.05
Educ.	.15		1.16
Engin.	.04		1.04
Health prof.	-.07		.93
Soc. serv. prof.	-.34		.71
Undecided	.30		1.35
All others	-.14		.87
HS: Quant. Reason.	.00		1.00
HS: Learn. Strat.	.00		1.00
Exp: Coll. Learn.	.01	*	1.01
Exp: Stud.-Fac. Int.	.01	*	1.01
Exp: Diverse Others	.00		1.00
Exp: Acad. Pers.	.00		1.00
Exp: Acad. Diff.	.00		1.00
Acad. Prep	.00		1.00
Imp: Campus Env.	.01	*	1.01
Constant	-4.74	***	.01

	Est.
Random Effects	
$\sqrt{\psi}$	.82
ρ	.17

*** p < .001, ** p < .01, * p < .05

Note: Results are the average from 20 imputed datasets. Standard errors were adjusted to account for the uncertainty of the imputation. Reference groups for categorical variables in parentheses.

Appendix B.
Sample balance tests after inverse probability weighting

	Non-participants		Participants		Mean Difference	SD
	Mean	SD	Mean	SD	(z-scored)	Ratio
Parental education						
Less than HS	.01	.11	.01	.12	.00	.99
HS diploma/GED	.19	.39	.20	.40	.04	.97
Some college	.08	.27	.08	.28	.01	.99
Associate's	.07	.26	.08	.27	.04	.94
Bachelor's	.28	.45	.28	.45	.01	1.00
Master's	.24	.42	.23	.42	.02	1.01
Doctoral/professional	.13	.33	.11	.31	.07	1.09
Race/ethnicity						
White	.75	.43	.75	.43	.01	1.00
Asian	.04	.21	.04	.19	.03	1.07
Black	.06	.23	.06	.24	.03	.94
Hispanic	.04	.20	.04	.20	.00	1.01
Multiracial	.10	.30	.10	.31	.00	.99
Other	.00	.06	.00	.07	.02	.85
SAT/ACT	1173	168	1156	172	.10	.97
Distance: home to college						
<1 hr.	.24	.43	.27	.44	.06	.97
1-2 hrs.	.20	.40	.21	.41	.02	.98
2-4 hrs.	.24	.43	.23	.42	.02	1.02
4-6 hrs.	.10	.30	.09	.29	.02	1.03
6-8 hrs.	.06	.24	.06	.23	.02	1.04
>8 hrs.	.16	.37	.15	.35	.04	1.04
Anticipated Major						
Arts & Hums.	.09	.29	.09	.29	.01	1.01
Bio. Sci.	.14	.35	.13	.34	.03	1.03
Phys. Sci.	.04	.19	.03	.18	.02	1.04
Soc. Sci.	.11	.31	.10	.30	.02	1.02
Business	.09	.28	.10	.30	.06	.93
Communications	.03	.17	.04	.20	.05	.88
Education	.08	.27	.09	.28	.02	.96
Engineering	.07	.26	.07	.26	.01	1.01
Health prof.	.13	.34	.14	.35	.03	.97
Soc. serv. prof.	.01	.12	.02	.13	.02	.91
Undecided	.17	.38	.15	.36	.06	1.05
All others	.03	.16	.03	.16	.01	1.02

	Non-participants		Participants		Mean Difference	SD
	Mean	SD	Mean	SD	(z-scored)	Ratio
Male	.25	.43	.25	.43	.01	1.01
HS grades						
As	.71	.45	.69	.46	.03	.99
Bs	.28	.45	.29	.45	.03	.99
Cs or lower	.01	.12	.02	.13	.02	.93
HS course challenge						
Not at all - 1	.01	.08	.01	.08	.01	.96
2	.03	.18	.03	.18	.00	1.01
3	.06	.24	.07	.25	.01	.97
4	.16	.36	.15	.36	.00	1.00
5	.34	.47	.34	.47	.01	1.00
6	.25	.44	.25	.44	.00	1.00
Very much - 7	.15	.36	.15	.35	.02	1.02
Friends attending the same college						
None	.56	.50	.53	.50	.07	.99
1	.18	.38	.18	.38	.00	1.00
2	.09	.29	.10	.31	.04	.95
3	.05	.22	.06	.23	.02	.95
4 or more	.11	.31	.13	.33	.05	.94
HS athletics involvement						
Not at all	.24	.43	.24	.43	.00	1.00
Very little	.08	.27	.08	.27	.01	1.01
Some	.13	.34	.13	.34	.01	.99
Quite a bit	.16	.36	.16	.36	.00	1.00
Very much	.39	.49	.39	.49	.00	1.00
HS arts involvement						
Not at all	.27	.44	.28	.45	.02	.99
Very little	.11	.32	.12	.32	.01	.99
Some	.13	.34	.14	.34	.01	.99
Quite a bit	.13	.33	.12	.33	.00	1.00
Very much	.36	.48	.34	.47	.03	1.01
HS vocational clubs involvement						
Not at all	.61	.49	.61	.49	.01	1.00
Very little	.13	.34	.14	.34	.02	.98
Some	.11	.31	.10	.31	.00	1.00
Quite a bit	.07	.25	.07	.25	.00	1.00
Very much	.08	.28	.08	.28	.00	1.01

	Non-participants		Participants		Mean Difference	
	Mean	SD	Mean	SD	(z-scored)	SD Ratio
HS volunteering involvement						
Not at all	.05	.21	.05	.21	.01	.98
Very little	.07	.25	.07	.25	.01	.98
Some	.21	.41	.21	.41	.00	1.00
Quite a bit	.28	.45	.28	.45	.01	1.00
Very much	.40	.49	.39	.49	.01	1.00
HS stud. govt. involvement						
Not at all	.55	.50	.56	.50	.01	1.00
Very little	.14	.35	.14	.35	.01	.99
Some	.12	.32	.11	.32	.01	1.01
Quite a bit	.08	.28	.08	.27	.00	1.00
Very much	.11	.31	.11	.31	.01	1.01
HS time co-curricular activities						
0 HPW	.04	.20	.05	.21	.02	.96
1-5 HPW	.17	.38	.18	.39	.03	.98
6-10 HPW	.20	.40	.20	.40	.01	1.01
11-15 HPW	.24	.43	.24	.43	.00	1.00
16-20 HPW	.15	.36	.15	.36	.01	1.01
21-25 HPW	.08	.27	.08	.27	.00	1.00
26-30 HPW	.03	.17	.03	.17	.00	1.01
> 30 HPW	.09	.28	.08	.27	.01	1.02
HS time preparing for class						
0 HPW	.01	.09	.01	.10	.01	.97
1-5 HPW	.27	.44	.29	.45	.04	.98
6-10 HPW	.29	.45	.29	.45	.01	1.00
11-15 HPW	.20	.40	.20	.40	.01	1.01
16-20 HPW	.11	.32	.11	.31	.02	1.03
21-25 HPW	.08	.26	.07	.25	.02	1.04
26-30 HPW	.02	.14	.02	.14	.02	1.07
> 30 HPW	.03	.16	.02	.15	.02	1.07

	Non-participants		Participants		Mean Difference	
	Mean	SD	Mean	SD	(z-scored)	SD Ratio
HS time relaxing and socializing						
0 HPW	.00	.07	.00	.06	.01	1.08
1-5 HPW	.23	.42	.23	.42	.00	1.00
6-10 HPW	.33	.47	.33	.47	.01	1.00
11-15 HPW	.19	.39	.19	.39	.01	.99
16-20 HPW	.12	.33	.12	.33	.01	1.01
21-25 HPW	.05	.22	.06	.23	.02	.96
26-30 HPW	.03	.16	.03	.16	.00	.99
> 30 HPW	.04	.20	.04	.20	.00	.99
HS: Quant. Reason.	31.97	15.06	31.66	15.08	.02	1.00
HS: Lrn. Strat.	41.37	12.73	41.01	12.92	.03	.99
Exp: Coll. Learn.	40.13	11.45	39.82	11.40	.03	1.00
Exp: Stud.-Fac. Int.	36.49	13.00	36.15	13.05	.03	1.00
Exp: Diverse Others	47.63	12.35	47.26	12.64	.03	.98
Exp: Acad. Pers.	45.93	8.44	45.80	8.65	.01	.98
Exp: Acad. Diff.	28.52	9.85	28.59	10.16	.01	.97
Acad. Prep	45.53	8.71	45.57	8.76	.01	.99
Imp: Campus Env.	48.58	8.50	48.26	8.46	.04	1.00

Note: Results are the average from 20 imputed datasets.