

Modeling the Success of Metropolitan College

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The Business-Higher Education Forum (BHEF) is the nation's oldest organization of senior business and higher education executives dedicated to advancing innovative solutions to U.S. education and workforce challenges. Composed of Fortune 500 CEOs, prominent college and university presidents, and other leaders, BHEF addresses issues fundamental to our global competitiveness. It does so through two initiatives: the **College Readiness, Access, and Success Initiative (CRI)**, addressing college and work readiness, access, and success; and the **Securing America's Leadership in Science, Technology, Engineering, and Mathematics (STEM) Initiative**, promoting America's leadership in STEM. BHEF and its members drive change locally, work to influence public policy at the national and state levels, and inspire other leaders to act. Learn more at www.bhef.com.

Acknowledgements

This report is the result of a series of meetings BHEF conducted summer 2010 in Louisville, Kentucky, to develop a plan focused on how two-year colleges can best contribute to baccalaureate degree attainment. These workshops were attended by more than two dozen education experts and community college stakeholders from across the country, including several from Louisville.

Daniel Sturtevant, president of Emtect Solutions and MIT doctoral candidate in the Engineering Systems Division, served as the project's principal consultant, researcher, and author. Though the workshops were focused on community colleges in particular, he framed these sessions by developing an education-workforce model based on the principles of system dynamics to demonstrate how modeling can be used to understand complex educational challenges.

This report describes the "Learn and Earn" model Sturtevant developed, which is based on Louisville, Kentucky's Metropolitan College, an educational partnership among United Parcel Services (UPS), the University of Louisville, and Jefferson Community and Technical College (JCTC).

The development of the Metropolitan College model and this report were particularly informed by several individuals. We would especially like to acknowledge Dr. Daniel Ash, vice president for Special Projects at Jefferson Community and Technical College and our subject-matter expert on this project, for his valuable input and suggestions. The model itself results from a series of interviews between Sturtevant and Ash. Dr. Parminder Jassal of the Bill & Melinda Gates Foundation also provided many helpful insights.

BHEF extends a special thanks to Greater Louisville Inc., Louisville's Chamber of Commerce, and the excellent staff there, who hosted both community college workshops and provided logistical support for our endeavors. In particular, Kathy Zandona, vice president for education at Greater Louisville Inc., provided exceptional support.

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Executive Summary

Concerns about U.S. competitiveness and innovation have led to greater scrutiny of the American education system. With increasing frequency, leaders in higher education, business, and government are calling for expanded educational opportunities to improve the skills of the U.S. workforce.

“Learn and Earn” programs offer one channel for ameliorating some of the workforce challenges that are of concern. Learn and Earn programs involve partnerships between postsecondary education institutions and employers to provide opportunities for adults to attend college while maintaining their employment. One such example is Metropolitan College, an educational partnership founded in 1998 among United Parcel Services (UPS), the University of Louisville, and Jefferson Community and Technical College (JCTC).

This report summarizes a project undertaken by the Business-Higher Education Forum (BHEF) that used a system dynamics modeling approach to understand the factors and describe the results that led to the success of Metropolitan College. The findings show that after Metropolitan College was introduced, employee demographics at UPS changed to reflect a better educated and more experienced workforce. In effect, Metropolitan College appeared to serve as a tool for attracting and retaining employees at UPS. The changing employee demographics resulted in financial benefits to UPS and the program saw a 600 percent return on investment.

Given that it effectively pinpointed vital reasons for Metropolitan College’s success, this relatively simple model can be a valuable tool for policymakers and other stakeholders interested in implementing new Learn and Earn programs. Specifically, for example, the model’s ability to sort more important factors from less important ones can help others who seek to adapt and scale the successful Metropolitan College model. The tool can help policymakers understand *why* prior successes occurred. Importantly, for those who would seek to replicate Metropolitan College’s success in their own community, system dynamics-based modeling can simulate the effect of important contextual differences *prior to* implementation. A generic Learn and Earn decision-aid tool could be built that incorporates collective wisdom about how these programs can be successful.

To view BHEF’s Metropolitan College Learn and Earn model, and to explore what happens when you change the context, visit: www.forio.com/simulate/bhef/learnearn.

Introduction

Learn and Earn programs are partnerships between academic institutions and corporations that provide postsecondary educational opportunities to help students improve their employment outcomes. These programs include a “learn” component, which incorporates a career-oriented academic curriculum, and an “earn” component, which includes student financial assistance. The benefits for students include an opportunity to acquire specific knowledge and skills that employers need, while they simultaneously earn a living. A benefit to employers is that Learn and Earn programs help attract and retain appropriately skilled employees. Thus, these programs provide a bridge that connects skilled workers with the employers that need them.

Learn and Earn programs come in many forms, including internships, cooperative education, apprenticeships, and work-study programs. Other models include career and technical education (CTE); engineering, and math programs; Professional Science Master’s (PSM) programs; and capstone courses.¹

One such Learn and Earn program, the Louisville-based Metropolitan College, is a joint education and workforce initiative among the state’s largest employer, United Parcel Service, the University of Louisville, and Jefferson Community and Technical College.

This report discusses the use of system dynamics modeling to analyze the factors that contributed to the success of Metropolitan College.

Metropolitan College

In 1998, UPS was operating a major overnight air hub out of the main regional airport in Louisville, Kentucky. Every day, some 2,000 part-time overnight workers would load packages into cargo planes destined for points around the globe. Louisville was a desirable logistical point because of its centrality and favorable weather patterns.²

UPS, however, wished to expand operations, necessitating growth from 2,000 to 5,500 workers. A number of challenges prompted UPS management to consider moving to an alternate location. First, the Louisville region did not seem large enough to provide a sufficient number of potential overnight workers to satisfy UPS’s demand, leading to a constrained labor market.³ Second, workforce morale was low and crews in the Louisville airport operated below the efficiency measured at other locations.⁴ Third, average employee turnover was high, leading to increased recruiting and training costs.⁵ Finally, because training times took longer than an average employee’s tenure at UPS, the majority of employees were operating below peak efficiency.

In response to these challenges, representatives from local government, institutions of higher education, and UPS management held emergency meetings in an attempt to craft a plan that would address these concerns. These meetings resulted in the formation of Metropolitan College.⁶

Not a college per se, Metropolitan College is an education program that offers access to postsecondary education opportunities for eligible participants—in this case, employees in the Next Day Air operation at UPS Worldport in Louisville, Kentucky who work part-time at UPS and receive wages and full benefits. Participants in Metropolitan College may attend Jefferson Community and Technical College or the University of Louisville, where they are eligible for full undergraduate Kentucky-resident tuition for all coursework that they complete successfully.

Since its inception in 1998, this innovative partnership has helped thousands of students receive a free education and on-the-job training, while reducing the annual turnover rate of new hires at UPS from 100 percent to less than 20 percent.⁷ Moreover, the introduction of Metropolitan College led to an increase in average employee tenure from eight weeks to 90 weeks, a factor that helped enable the Louisville labor market to sustainably meet UPS's need for additional staff.⁸ In addition, while UPS originally believed 5,500 employees would be necessary to meet capacity demands, productivity gains of the workforce post-Metropolitan College allowed them to do the same work with lower headcount than anticipated. These factors allowed Louisville to become one of the most efficient air-hubs in the United States. The Metropolitan College program produced a financial return on investment of approximately 600 percent.⁹

Using System Dynamics Modeling to Evaluate Policy

Since the success of Metropolitan College, a number of companies and communities have attempted to adapt and replicate the program under the banner “Learn and Earn.” Although some of these Learn and Earn programs are doing well, others have experienced less success. The reasons for these different outcomes often are rooted in important situational and contextual differences. In order for policymakers and other stakeholders to be more successful at replication, adaptation, and scaling of such programs, it may be beneficial to understand *why* the policy or program worked in its original context and *how* it will behave when factoring in differences found in a new situation.

System dynamics modeling, a methodology developed at MIT in the 1960s, is one way to frame and understand complex issues and problems, such as the interplay between educational and economic systems. The approach allows numerous challenges to be examined simultaneously, helping policymakers, in turn, to deepen their understanding of issues that typically are analyzed independently.¹⁰ When combined with computer simulations, this method can forecast how the behavior of a system changes over time.

The Metropolitan College Model¹¹

In the context of a recent series of workshops exploring the role of community colleges in educational attainment and workforce preparation, the founding director of Metropolitan College was interviewed to explore the factors that help explain *why* Metropolitan College was successful.¹² The design of the model is depicted as a causal influence diagram in Figure 1.

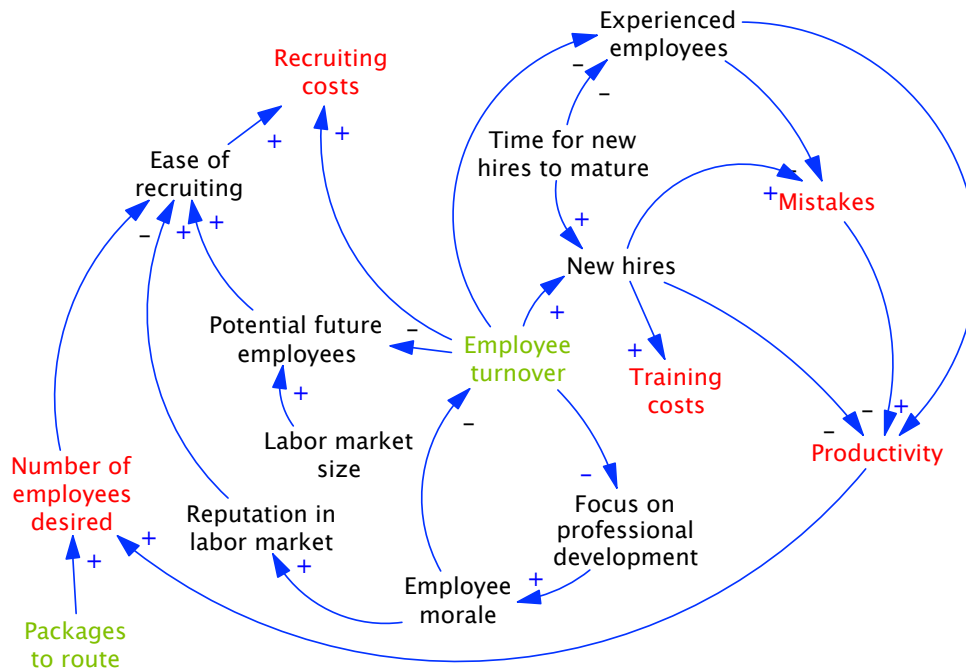


Figure 1: Relationships underpinning the Metropolitan College program.

Causal influence diagrams contain variables and causal arrows indicating relationships that exist between those variables.¹³ The interaction among different components is explained in terms of feedback within the system. For example, factor A can influence B, while over time B also affects A.¹⁴ Arrows with a plus sign indicate that an increase in one variable will cause an increase in another. Arrows with a minus sign indicate that an increase in one variable will cause a decrease in the other. In Figure 1, for example, an increase in “Employee turnover” will increase the percentage of “New hires,” thereby decreasing “Productivity.”¹⁵ It will also decrease “Focus on professional development,” in turn decreasing “employee morale” and, finally, again increasing “Turnover.”¹⁶

In Figure 1, variables marked in red are those that affect company performance. As noted previously, in the 1990s, UPS perceived its Louisville overnight shipping operations to be hindered by low employee productivity and high costs of training and recruitment. UPS wished to more than double the number of packages that could be routed through Louisville, but the potential labor pool was not adequate to meet this increased demand. As will be shown, the creation of Metropolitan College played a major role in correcting this situation, largely by decreasing employee turnover.

Based on the causal loop structure described above, a system dynamics model was created to explore the relationships among different components of the Metropolitan College system. This model includes data and assumptions that capture the interaction among the different factors that resulted in the success of Metropolitan College. The underlying structure of the model is represented in Appendix 1.

This structure allows users to explore the impact of a number of scenarios by testing different policy options, independently and in combination. (Users of the free web-based version can test their own policy choices in the model at www.forio.com/simulate/bhef/learnearn.¹⁷) The results shown in this report tested the following three scenarios:

1. **Baseline:** This scenario illustrates the continuation of UPS in Louisville prior to 1998, with no increased demand. This simulation is a baseline to which the other two simulations are compared.
2. **Expand without Metropolitan College:** This scenario simulates an increase in the demand for workers from 2,000 to 5,500 without introducing Metropolitan College (MC).
3. **Expand with Metropolitan College:** This scenario simulates an increase in the workforce demand to 5,500 employees and the introduction of Metropolitan College (MC), with 80 percent of the UPS Next Day Air employees participating in Metropolitan College.¹⁸ This scenario reflects what actually happened in Louisville.

Figure 2 depicts the changes in employee composition for each of the three possible scenarios. In the **baseline scenario**, with flat demand and without Metropolitan College, “new hires” (orange line) constitute the largest category of employees, while “experienced employees” (red line) are the smallest.¹⁹ When the **expand without MC scenario** increases the demand for workers without providing Metropolitan College, the number of employees spikes, with the largest increase seen in “new hires” (orange line), but quickly taps out the available labor pool. When the **expand with MC scenario** adds Metropolitan College to the increased demand, a demographic shift occurs where a large proportion of employees are on the college-going track (blue, green, and purple lines).²⁰ These results show that after a transition period, “veterans in MC” (green line) employees become the most common type of worker, while the “new hires in MC” (blue line) are the second largest group of employees.

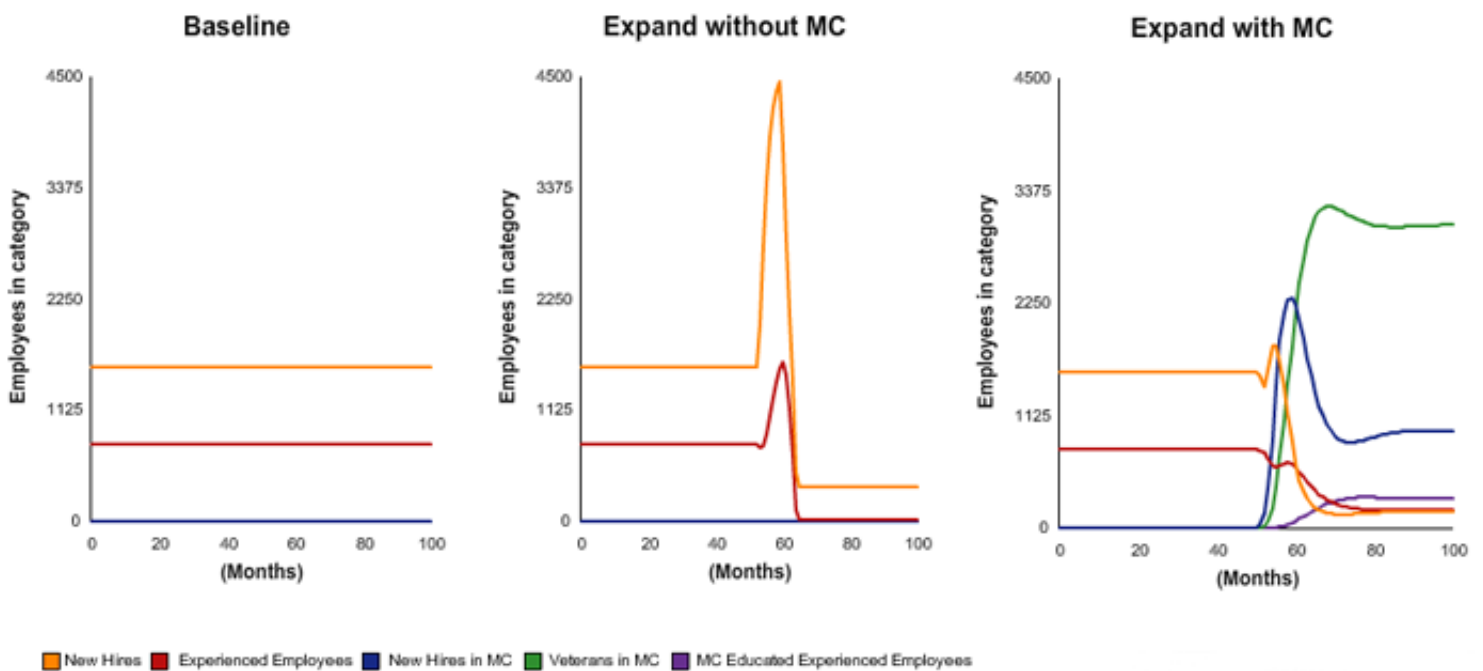


Figure 2: The workforce composition of UPS employees.

Figure 3 illustrates the impact of Metropolitan College on workforce productivity. With constant labor demand and in the absence of Metropolitan College, workers operate at a low productivity level, primarily due to the high number of new hires (orange line).²¹ Moreover, the productivity of workers falters even further as increased demands are placed upon the existing available workforce without introducing Metropolitan College (red line). Once Metropolitan College is introduced, an increase in the number of experienced, college-going employees at UPS drives productivity gains (blue line).

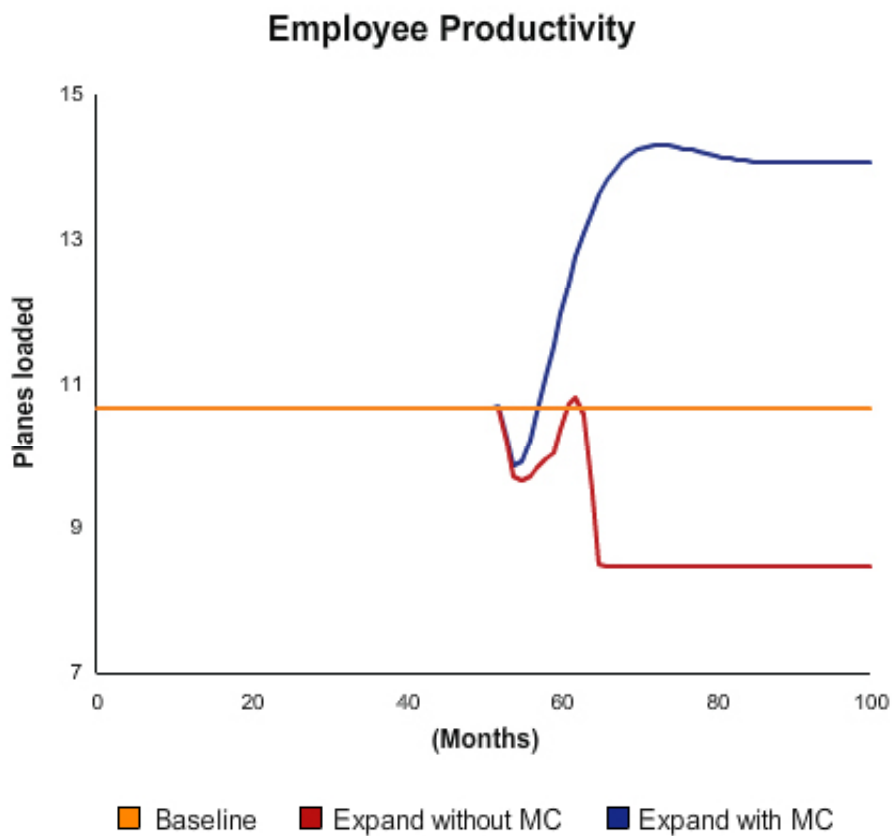


Figure 3: Workforce productivity of employees at Metropolitan College.

Figure 4 reports effects on employee morale under the three scenarios. In the absence of Metropolitan College, employee morale is low (orange line), and it decreases even further with an increased workload (red line), as the region is unable to meet demand for additional employees. With the introduction of Metropolitan College, employee morale increases and experienced workers are very productive, have longer tenure in their positions, and share greater camaraderie. Since workers occupy their position for a much longer time and are more productive, management is more likely to treat these workers in a professional and collegial manner. These changes lead to an increase in employee morale (blue line). Overall, an increase in the productivity and morale of workers decreased the attrition rate of employees at UPS.

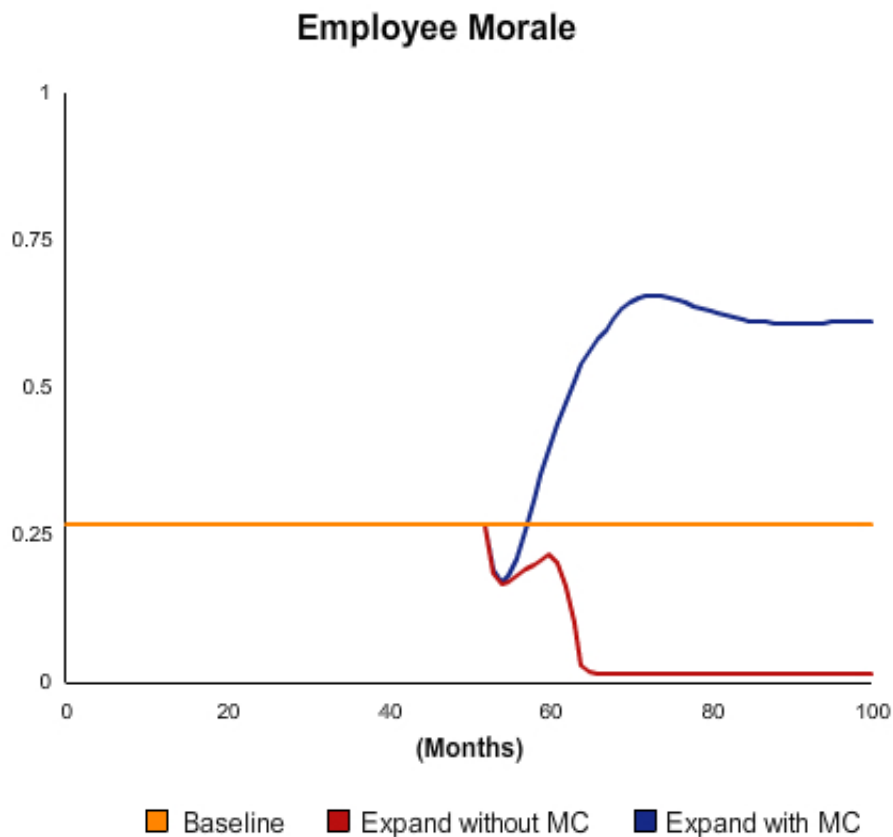


Figure 4: Morale of employees at Metropolitan College.

The changes in employee demographics also resulted in benefits to UPS and the Louisville region. As shown in Figure 5, in the absence of Metropolitan College, UPS was exhausting the “Potential Labor Pool” of workers appropriate for the job faster than demographic shifts in Louisville could replenish it. A workforce of 2,000 with an average tenure of only eight weeks could not be supported by a labor market the size of Louisville’s (orange line). With an increase in workforce demand to 5,500 employees, UPS exhausts the labor pool entirely and in a very short timeframe (red line). In contrast, the employee retention experienced after implementing Metropolitan College allows the potential labor pool in Louisville to be replenished faster than UPS must hire to sustain its workforce, even with a demand for 5,500 workers (blue line).

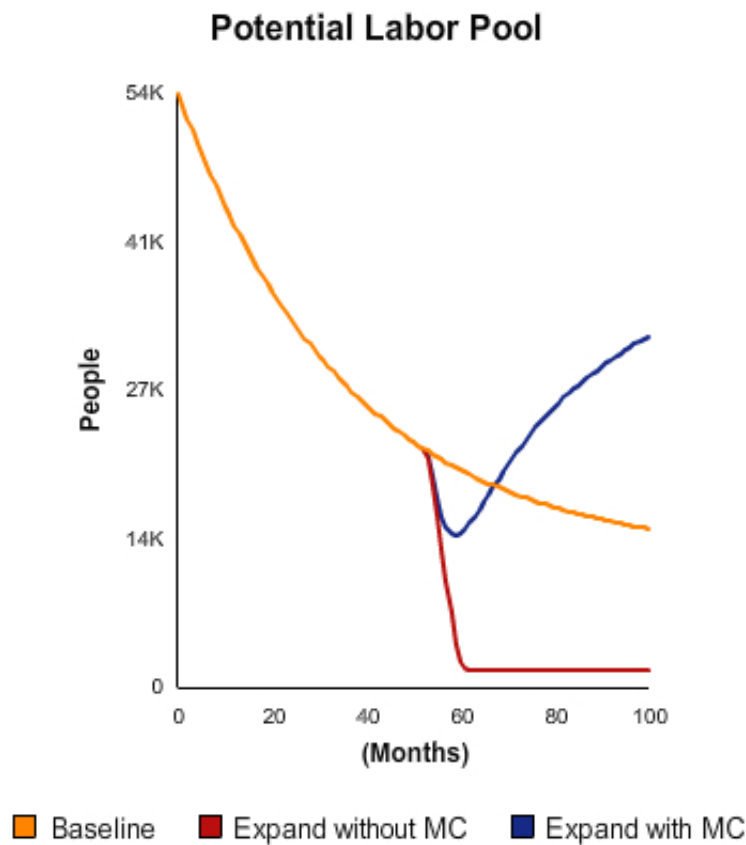


Figure 5: Potential labor pool in Louisville.

Figure 6 illustrates a pleasant surprise encountered by UPS management after the implementation of Metropolitan College. The additional demand for workers at UPS was initially forecasted to be around 5,500 workers; due to decreased productivity with all of the new hires, the demand for new employees would actually go higher over time nearing nearly 8,000 (red line).²² Conversely, this initial forecasting for additional employees did not anticipate the productivity gains that would accrue from an experienced workforce with high productivity and morale. UPS management eventually realized that only 4,500 highly productive workers could accomplish the same work (blue line).

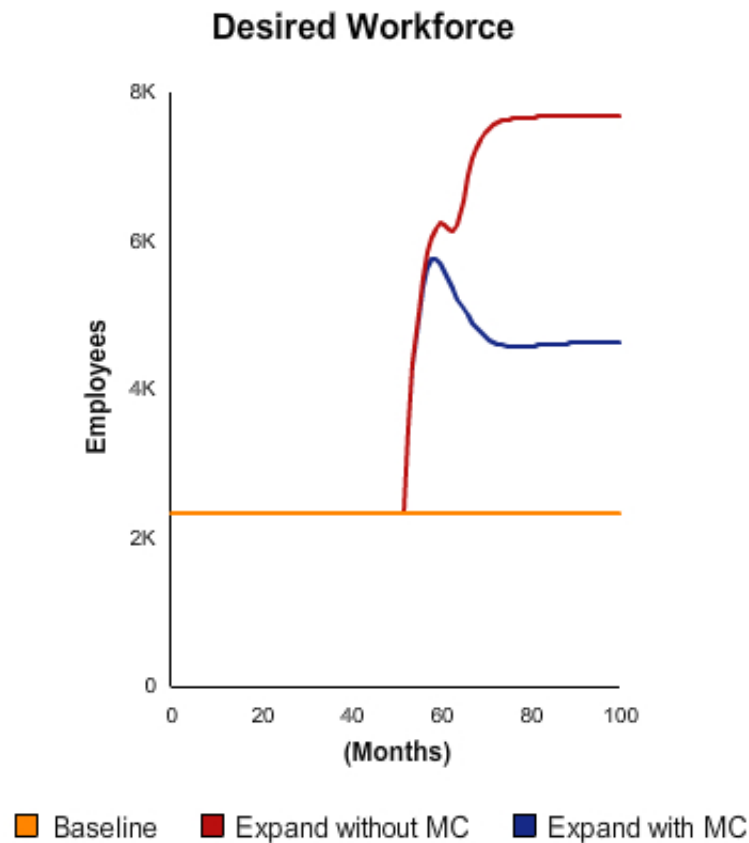


Figure 6: Desired workforce at UPS.

Figure 7 depicts the hiring required on a “per slot” basis. Prior to Metropolitan College, high employee attrition required each slot to be filled every other month on average (orange line). Upon introduction of Metropolitan College, this requirement was reduced substantially due to decreased employee attrition (blue line). The reduced hiring requirements “per slot” resulted in large cost savings for UPS by eliminating the need for recruitment and training activities.

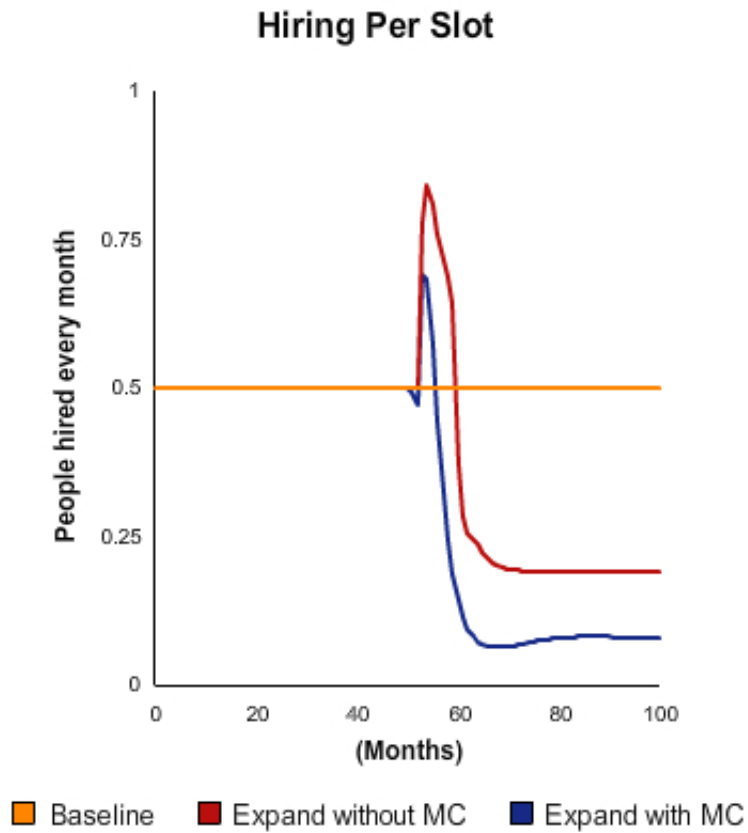


Figure 7: Hiring per slot at UPS.

Discussion and Future Directions

The model described in this case study illustrates how interaction among different factors contributed to the success of Metropolitan College, as reflected in such trends as decreased employee attrition resulting in longer tenure and higher productivity. Employees became so productive that the number of additional employees required for capacity expansion was substantially lower than the initial forecasted demand. Further, due to the decrease in employee attrition upon introduction of Metropolitan College, UPS could expand its labor force without exhausting the entire labor pool in Louisville.

Having proven its success in Louisville, the Metropolitan College model could inform and help shape a wide range of Learn and Earn scenarios, especially with the right input from policymakers and experts focused on the particular circumstances of companies and communities that seek to adopt the model.

To companies and communities that might be interested in adapting a similar approach, we offer a few caveats based on the Metropolitan College experience. One point is that Metropolitan College solved a set of issues that were specific to Louisville. It is important to note that education and workforce challenges facing communities other than Louisville may be different, and may thus affect success rates. Moreover, the factors responsible for the success of Learn and Earn programs often change over time, requiring stakeholders to recalibrate their assumptions about a program's success.

A company or city should work with qualified analysts to explore, adapt, and improve the Metropolitan College model in the context of specific local circumstances, as a means to help test the implications of policy decisions prior to their implementation in the real world. Such an approach would offer critical insights into what might work and what must be adapted to implement a model similar to Metropolitan College in a new environment.

Similarly, policymakers seeking to implement a Learn and Earn program modeled on Metropolitan College would benefit from studying that model and then working with experts to adapt it to new circumstances.

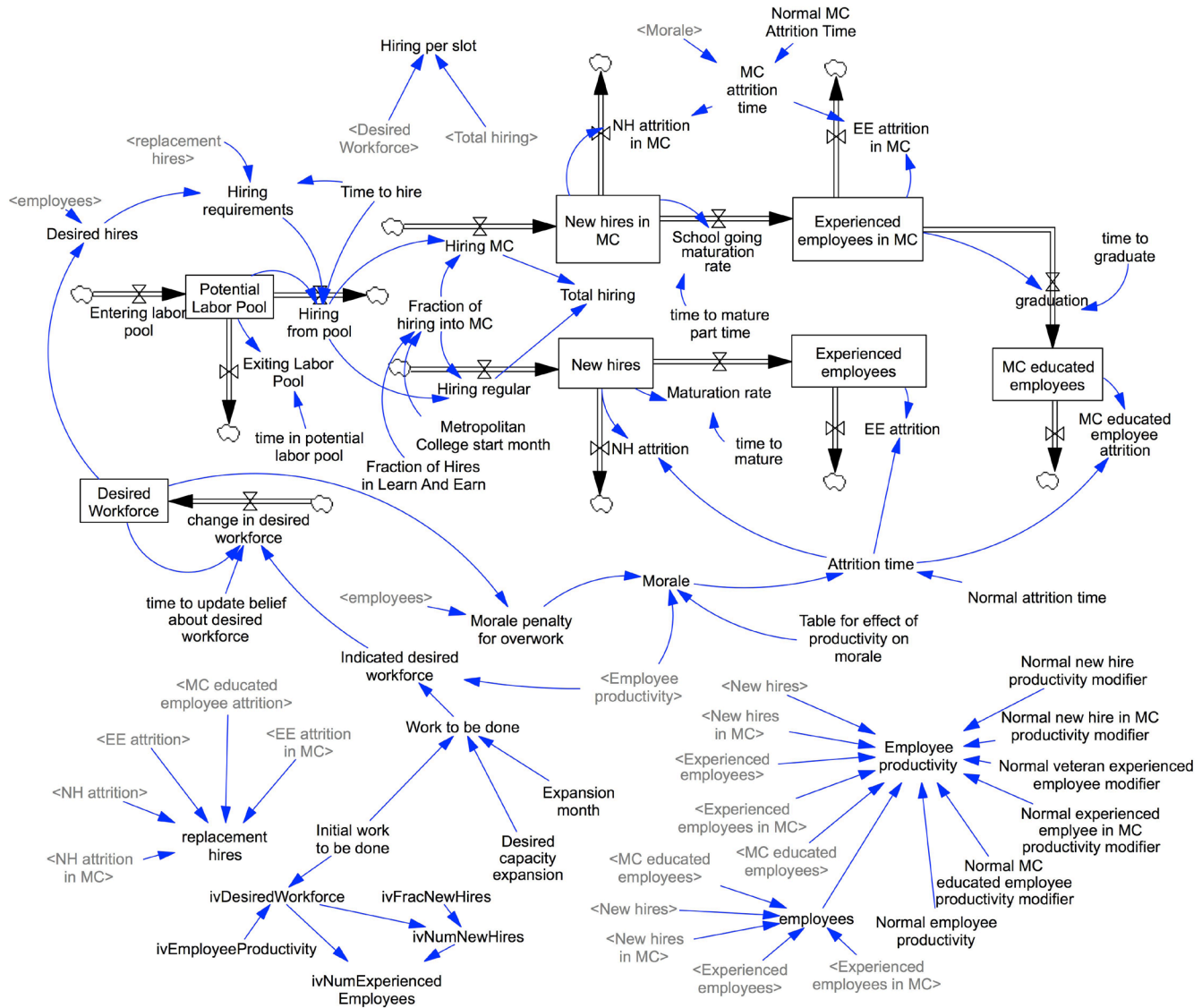
In its current form, the Metropolitan College model described in this paper should be used to fuel discussion and offer areas for exploration to those who seek to implement or improve Learn and Earn programs. With incremental improvement, the model could mature into a robust and generalizable tool that would help policymakers and other key stakeholders to make informed decisions.

To view BHEF's Metropolitan College Learn and Earn model, and to explore what happens when you change the context, visit: www.forio.com/simulate/bhef/learnearn.

Endnotes

1. Gardner, P.D., and Bartkus, K.R. (2010). *An analysis of U.S. Learn and Earn programs*. Research funded by the Bill & Melinda Gates Foundation.
2. Poling, G., and Stamper, K. (January 2010). *Metropolitan College Overview Presentation*. Louisville, KY: Metropolitan College. Note: Prior to the expansion in operations, the workforce averaged approximately 2,000 employees, though it fluctuated somewhat based on workload. For the purpose of this paper, we assume this number to be the baseline.
3. Forecasting indicated that the Louisville labor market was too small to provide enough potential overnight workers to fully satisfy UPS's demand for 2,000 employees in the long-term, let alone 5,500 employees.
4. For the purpose of this paper and accompanying model, our subject-matter expert suggested setting the efficiency at 70 percent, below that in other locations.
5. According to conversations with subject-matter experts, an average employee quit UPS after only eight weeks.
6. For more information, please visit: <http://www.metro-college.com/aboutus/default.aspx>. Retrieved on April 1, 2011.
7. Soares, L. (2010). *The power of education-industry partnership: Fostering innovation in collaboration between community colleges and businesses*. Washington, D.C: Center for American Progress.
8. Riggert, S.C., and Ash, D. (2004). Metropolitan College: Building community value through education-business partnerships, *Innovative Higher Education*, 29(1); *Metropolitan College Overview Presentation*, January 2010.
9. Soares, L. (2010). *The power of education-industry partnership: Fostering innovation in collaboration between community colleges and businesses*. Washington, DC: Center for American Progress.
10. Watkins, K.E., and Marsick, V.J. (1993). *Sculpting the learning organization: Lessons in the art and science of systemic change*, San Francisco: Jossey-Bass.; Wolstenholme, E.F. (1999). Qualitative vs. quantitative modeling: The evolving balance. *Journal of the Operational Research Society*, 50: 422-428.; Wolstenholme, E.F. (1992). The definition and application of a stepwise approach to model conceptualization and analysis, *European Journal of Operational Research*, 59: 123-136.
11. A free, web-based user interface for this model is available. Please visit: <http://www.forio.com/simulate/bhef/learnearn>.
12. Many thanks go to Dr. Daniel Ash for serving as a subject-matter expert in the creation of this preliminary model. Dr. Ash was instrumental in the design and operation of Metropolitan College during its formative years.
13. Variables are defined as factors of interest identified by the different stakeholders who helped to develop the model.
14. Arrows do not move from one direction to another.
15. Employee turnover reflects the total number of employees leaving an occupation.
16. The "focus on professional development" variable is defined by the level to which management treats employees as a long-term investment.
17. The free web-based version can be found at <http://www.forio.com/simulate/bhef/learnearn>.
18. According to our subject-matter expert, 80 percent of UPS employees at the UPS Next Day Air facility participated in Learn and Earn.
19. In the figure, "new hires" have been at UPS for under 12 weeks; "experienced employees" have been at UPS for at least 12 weeks; "new hires in MC" have been at UPS for less than 12 weeks and are enrolled in Metropolitan College; "experienced employees in MC" have been at UPS for at least 12 weeks and are enrolled in Metropolitan College; and "MC educated experienced employees" have been at UPS for at least 12 weeks and successfully completed Metropolitan College.
20. Poling, G., and Stamper, K. (January 2010). *Metropolitan College Overview Presentation*. Louisville, Ky: Metropolitan College.
21. For the purpose of this simulation, our subject-matter expert suggested the assumption that the workforce productivity for new hires is 1:10 while that for experienced employees is 1:16.
22. Based on conversations with subject-matter experts.

Appendix 1



Metropolitan College system dynamics model structure.



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