

## **Revolutionizing Transfer: A Novel and Holistic Programmatic Model that Eliminated the Visible and Invisible Barriers to Student Success**

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## **ABSTRACT**

The Guided Pathways initiative is among many reform efforts that have been implemented by hundreds of community colleges in the country. Four main practice areas are intrinsic of Guided Pathways: 1) mapping pathways to students' end goals, 2) helping students choose and enter a program pathway, 3) keeping students on a path, and 4) ensuring that students are learning. Although this approach is an important step toward successful transfer placement, the Guided Pathways do not address the visible and invisible barriers to student success once students transfer to a 4-year institution.

This paper presents a novel and holistic approach to transfer that eliminates visible and invisible barriers to student success. The Holistic and Programmatic Approach for Transfer (HPAT) model includes early and active participation of the 4-year transfer partner, structured within a well-thought-out transfer articulation agreement that builds on a joint commitment to quality and student success. Integral to the agreement is the requirement for the rigor of the curriculum at the community college to match that of the 4-year partner, along with exceptional student support, financial assistance and mentoring from the point of admission at the community college, through transfer, and up to the bachelor's or master's degree completion.

Unique to this model is the fully collaborative and holistic approach to admission; curriculum alignment, including content; participation in co-curricular activities; co-advising; co-mentoring; and data sharing that drive continuous improvement. Students in the program are concurrently registered in both the community college and the 4-year partner institution becoming part of both student communities from the start. These students take classes at the 4-year partner at a discounted price while still enrolled at the community college, thus eliminating curricular barriers, ensuring placement as juniors, and facilitating belonging at the transfer institution. In addition, program-specific courses and activities at the transfer institution aim to eliminate the socialization and adjustment barrier upon transfer, further increasing belongingness to both institutions.

Preliminary outcomes promise a ninety-five percent (95%) transfer rate within 2-3 years from admission. The Program's success is attributed to a holistic and programmatic approach for transfer that emphasizes cross-institutional commitment, effective mentoring, rigor, quality, and increases belonging to the engineering profession (measured through a belonging survey and "Appreciative Inquiry" case study interviews). Although this approach is Engineering specific, our model is positioned to revolutionize transfer that can be duplicated for other Science Technology, Engineering, and Math (STEM) and non-STEM disciplines.

## **1. INTRODUCTION**

Community colleges play a crucial role in higher education in the US, STEM education included [1, 2]. Nearly half of all college students are currently enrolled in community colleges, majority of which are Black and Latino/a, as well as low-income, first generation and older students. [3] In 2017, thirty-eight percent (38%) of engineering graduates attended a community college at some point in their studies. [4, 5] As a lower-cost alternative to 4-year colleges and universities,

community colleges are considered a gateway into higher education. [2] However, transferring from community college and completing a bachelor's degree is not always straightforward especially for low-income students. Although eighty percent (80%) of students attending community college hope to transfer and complete a 4-year college degree, the Fall 2020 National Student Clearing House Research Center Report transfer data shows otherwise. Lower-income students who began postsecondary education at a community college in Fall 2013, were half as likely to transfer to a 4-year institution (24%-40%) and attain a bachelor's degree (10% vs. 21%) within six years of first entry. [6] To improve these outcomes, several ideas have been implemented, including co-enrollment in a 4-year institution, structured pathways, one-stop wrap around support, and reimaging remediation. [7] However, community college transfer rate and subsequent bachelor's degree completion remain low. [6]

Currently, Guided Pathways initiatives are implemented by hundreds of community colleges in the country. [8, 9] These initiatives have four practice areas: 1) mapping pathways to students' end goals, 2) helping students choose and enter a program pathway, 3) keeping students on a path, and 4) ensuring that students are learning. [8, 9] The main goal is to graduate and transfer more students within certain timeframe by providing guidance and support needed for students to stay on track to graduation. Although this approach is an important step toward successful transfer placement, the Guided Pathways do not address the visible and invisible barriers to student success once they transfer to 4-year institutions. A step-up to the Guided Pathway incorporates participation of 4-year transfer institutions during orientation [10], which has shown to be beneficial. However, it is not sufficient since orientation is only the beginning. The transfer process is a shared responsibility between community colleges and 4-year transfer institutions, understanding that both institutions are essential in advancing students to the bachelor's degree. [11]

This paper presents a novel model that brings the Guided Pathways' four practice areas to a higher level that extends to, and includes early and active participation of the 4-year transfer partner from talent identification up to bachelor's or master's degree completion. This paper outlines the development, implementation, and evaluation of the Holistic Programmatic Approach for Transfer (HPAT) model. The model is built on a well-thought-out program design reflected in a transfer articulation agreement and a joint commitment to quality and student success. Integral to the approach is the requirement that the rigor of the curriculum at the community college matches that of the 4-year partner. In addition, faculty, administration, and staff work synchronously and collaboratively to provide intentional student support at each institution, with financial assistance up to the master's degree completion. Holistic student support implements the programmatic frameworks described by Espiritu *et.al.* [12], including one-stop intentional advising; mandatory tutoring; near-peer, faculty, and professional mentoring; and access to professional organizations. These frameworks are essential in developing the sense of Community of Practice (CoP) for students, which play a direct role in student's self-efficacy at both institutions [13, 14, 15, 16].

Planning, implementation, and evaluation of the HPAT model has become an institution-wide, cross-institutional, effort that incorporates broad engagement and collaboration, and fosters continuous improvement. This paper emphasizes the benefits of a fully integrated approach to co-branding and co-marketing; co-admission; opportunities to participate in co-curricular activities at both institutions; curriculum alignment, including new content development; co-advising and co-mentoring; and sharing of data that drive continuous improvement. The process of creating a model that can be reproduced by other institutions, or modified for best adaptation to its own environment, is described. We present and discuss the preliminary outcomes for the first-year

implementation. The HPAT model, although developed and established for engineering programs, is expected to revolutionize transfer across other STEM or non-STEM disciplines, upon adaptation and successful implementation. Figure 1 outlines the HPAT model.

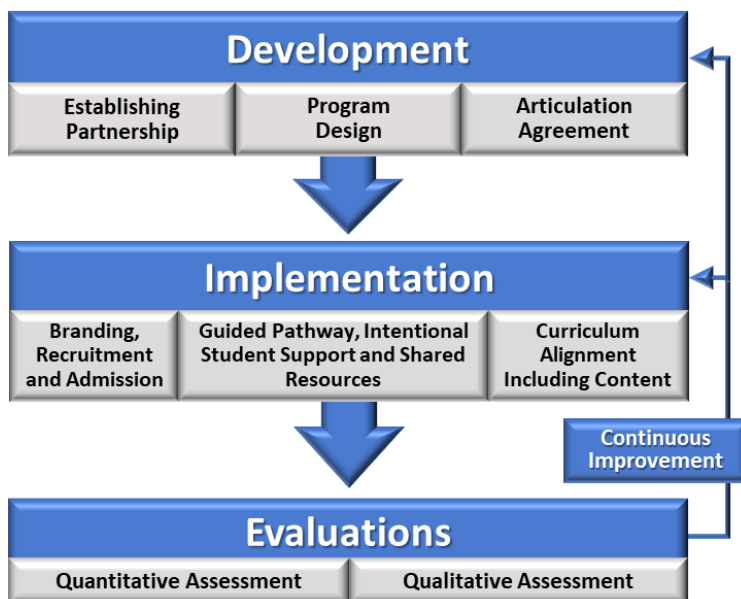


Figure 1. The Holistic Programmatic Approach for Transfer (HPAT) Model

## 2. METHODS

The HPAT model was developed by combining literature’s best practices [10] with an intentional framework contextualized for the transfer partnership between community colleges and 4-year institutions. The model emphasizes an “ideal partnership” as the key to creating a program that fills the gap currently observed in serving the unique needs of transfer students. The strengths and the unique attributes of each institution, including culture, practices, policies, and the diversity of student population are guiding elements carefully considered in developing the model. Of additional relevance supporting the building of an ideal partnership are the geographical location and proximity of the partner institutions, local employer and industry engagement, shared interest for community impact, and enabling seamless student financial aid across the partner institutions.

### 2.1. The Developmental Stage

#### 2.1.1. Establishing a Partnership: Finding the Best-Fit

Initiating and adopting a holistic and programmatic approach for transfer needs to be fully customized to the mission and /goals of both institutions. The transfer partnership can be initiated by either institution. Finding the best-fit partner can be challenging, considering the differences between community colleges and 4-year institutions, but the historical data can streamline the search. An initial feasibility research which considers historical transfer, students’ preferences, and institutional culture for transfer should be performed. The motivation for initiating the partnership should be clearly supported by institutional data and a clear understanding and alignment of the mission and goals of each institution. This is followed by identifying the lead person at each partner institution that will take on the responsibilities and challenges of program development,

implementation, evaluation, and continuous improvement. Finding the best-fit institutions, aligning goals, finding the lead personnel, and merging the program goals are vital steps in initiating the HPAT model.

### **2.1.2. Well-Thought-Out Program Design**

Aligning the goals of both institutions and setting the expectations are fundamental elements to the development and success of the HPAT model. The lead person from each partnering institution creates a small team to design the program. The team members are required to have the expertise, commitment, thorough understanding of the transfer students' unique needs, and capability to affect change. Understanding the transfer students' unique needs (including the possible academics gaps, belonging to the transfer institution, and financial challenges) is the very core of the program design. A well-thought-out program design centered on understanding the transfer students is imperative to creating an effective articulation agreement.

### **2.1.3. An Effective Articulation Agreement**

The sustainability of the program can be considerably improved by developing a legally binding contract in the form of an articulation agreement between the community college and the transfer institution. The articulation agreement needs to address the program design, the conditions for implementation, the limitation of the program, the commitment from both institutions, and the assessment process providing room for possible modifications towards continuous improvement. An effective articulation agreement should emphasize institutional commitment to successful implementation and high-quality standards. Clear guidelines for institutions to adhere to, including all the terms of agreement for evaluation and provision of personnel accountable for implementation, should be provided.

#### ***2.1.3a. Program Design***

##### ***2.1.3a.1. Personnel Requirements***

Each institution is required to provide a champion who will lead the program and be accountable for the implementation, assessment, and any required program modification. This champion, or lead academic officer, will be responsible for creating the institution's team and will serve as contact person to communicate with the partner institution.

##### ***2.1.3a.2. Admission and Academic Requirements***

Admission requirements including grade point averages and overall students' eligibility criteria should be clearly delineated in the agreement, along with the process for student evaluation. Admission requirements should be agreed by both institutions.

##### ***2.1.3a.3. Program Benefits***

Program benefits are to be clearly articulated in the agreement, including but not limited to guaranteed admission to the transfer institution, dual-enrollment, transfer scholarships and discounted tuition fees.

#### ***2.1.3b. Curriculum***

The commitment of each institution to the quality of education and rigor of the curriculum is included in the agreement. The semester-to-semester map of courses including correct course sequence and commitment to align course content is explicitly stated in the agreement with the commitment to review and improve. All fields and majors covered by the articulation agreement are specified. A commitment to develop new content, when needed, to facilitate an academic

seamless transition is articulated in the agreement. The partner institutions will together identify the need, and any new content to be introduced in the curriculum within the HPAT program is to be developed in close collaboration with active participation of faculty from both institutions.

### ***2.1.3.c. Assessments and Continuous Improvement***

It is extremely important that both institutions agree to assess the program implementation and share the data for continuous improvement. The commitment to review and improve the program design and implementation should be included in the articulation agreement.

### ***2.1.3.d. Limitations***

The limitations of the program including length of contract should be addressed. It is recommended that the articulation agreements are five (5) year contracts with option to renew. Conditions for renewal are included in the agreement.

## **2.2. The Implementation**

The implementation of the HPAT model requires a combined effort of both partners at all stages of a student's career. This requires an early and active participation of the 4-year partner from the time of admission, until the student completes the bachelor's or master's degree. Additionally, it implies a continuous participation of the 2-year partner through mentoring, and longitudinal program assessment for continuous improvement. Various curricular, co-curricular, and extracurricular activities are encouraged to be developed in each of the partner institutions with some overlap whenever possible. This will support student transition from the community to the 4-year college, build on a sense of belonging from an early stage, and contribute to retention.

### **2.2.1. Branding, Recruiting, and Admission**

Both institutions need to ensure that all aspects of the program and services, including marketing, branding, recruitment efforts, and admission are aligned. Marketing and Communication departments in each institution collaboratively create a brand and recruiting materials that holistically project the partnership. Although the initial admission to the program is mainly executed by the community college, the 4-year partner collaborates in building the criteria and actively refers students to the program for admission.

### **2.2.2. Individualized Pathway and Intentional Student Support Framework**

In a collaborative effort, the community college and the 4-year transfer institution are expected to build unique frameworks that successfully support students from admission until the completion of the bachelor or master's degree.

#### ***2.2.2a. Individualized Guided Pathway***

The HPAT model recognizes that each student has unique backgrounds and needs. In addition to students from different race, culture, gender, and socio-economic background, each student may exhibit a different level of academic preparedness. The HPAT model assesses students' academic background and designs a pathway individualized to the needs of each student, that includes early identification of the major aligned to student's initial interest with flexibility for modification within specified length of time (designated in the articulation agreement).

### ***2.2.2b. Intentional Student Support Including Co-Advising and Co-Mentoring***

The integration of student support with academics is crucial to successful implementation of the HPAT model. Student support extends beyond traditional academic advising, mentoring, and tutoring to incorporate other services such as financial aid and wellness. In addition, the HPAT model identifies barriers to student success that are prevalent in under-represented and under-prepared groups, and removes or neutralizes those barriers through targeted interventions. HPAT advisers, trained to work collaboratively across the two institutions, work closely with academic departments to provide optimal guidance and support, enabling students to make steady progress and complete their programs on schedule. [17]

### ***2.2.2c. Developing Belonging to the Program and to the Profession***

Another unique aspect of the HPAT model is the creation of courses that develop student's knowledge of the profession and the institutions. Through these courses, and other enrichment activities specific to the HPAT, students see themselves as members of both institutions, and develop the sense of belonging, a very important factor to keep students motivated and focused, increase retention, and enhance overall student success. [13]

### **2.2.3. The Curriculum Alignment Including Content**

All fifty states have transfer initiatives and have policies for transfer [18] that facilitate transfer from community college to 4-year institutions. For example, in Illinois, through the Illinois Articulation Initiatives (IAI), students are provided guaranteed transfer if they have an associate degree and students who completed the Illinois General Education Core requirement will receive credit for low-division courses. The articulation initiative, however, is limited to general education courses and is not aligned to specific majors, such as engineering, at participating institutions. For Engineering, completing an unaligned associate degree at a 2-year institution spells longer time to bachelor's degree completion. Even the IAI approved Associate degree in Engineering Science completion does not guarantee success at the transfer institution. The HPAT model addresses this shortcoming by requiring the alignment of the curriculum and its contents between partner institutions. It aims to eliminate the existing invisible academic barriers that lengthen time to degree completion by

- having a consistent curriculum with shared responsibility of rigor and quality of education including content between 2-year and 4-year
- creating a proper semester-to-semester course sequence
- identifying gaps especially in prerequisite courses that can be offered at the community college
- providing students with the option to take strategically selected courses at the 4-year partner institution while at the community college, thus eliminating curricular barrier and ensuring seamless junior standing after transfer.

### **2.3. Evaluations**

The HPAT model is based on the guiding principle that successful implementation and sustainability of the transfer pathways is institution-specific, and requires evaluation and modification of implemented practices for continuous improvement.

### **2.3.1. Quantitative Assessment**

The key performance indicators commonly used to quantitatively assess the transfer pathways include retention rates at all levels, associate and bachelor's graduation, and transfer rate. In addition to these common indicators, assessment of the HPAT model utilizes admission data (high school GPA, Math and English placement, and student demographics), transfer GPA, time to degree completion, and graduation rate for determining longitudinal outcomes. These metrics provide a relatively simple, and more comprehensive, set of leading indicators of longitudinal success that can be measured for each student cohort and compared year-to-year.

### **2.3.2. Qualitative Assessment**

The quality of the program will also be assessed. All students admitted to the HPAT model are expected to respond to an online survey that addresses belonging and self-efficacy. Appreciative Inquiry [19] will be used for Case Study interviews to continuously improve the model. Students are randomly selected for Case Study interviews at the time of exiting the community college and upon graduation at the 4-year institution.

## **3. PRELIMINARY RESULTS: HPAT MODEL: IIT-WRIGHT ENGINEERING PROGRAM**

### **3.1. Development**

Wright College, an open-access community college in northwest Chicago, is an independently accredited institution in the City Colleges of Chicago (CCC) system. Illinois Tech (IIT) is a 4-year ABET accredited private institution in Chicago. While Wright College students had transferred to IIT for several years, and the two institutions had recognized the value of the existing relationship, it wasn't until 2018, through NSF sponsored project led by Wright College, that the two institutions embarked on a targeted effort towards improving the student transfer experience and overall success. Wright College has identified the Armour College of Engineering at IIT as one of the top transfer schools. After assessing the key features of both institutions in the context of institutional culture for transfer and potential for aligning their institutional goals, both institutions created a team to first identify key elements supporting the building of an "ideal partnership" and moved on to forming the program design. The Program was designed by merging the best practices from a successful Wright College engineering program with IIT's parallel initiatives. The new Engineering Transfer Program was customized to fit both institution's strengths, cultures policies, and to combine efforts to fill in the gaps to serve the needs of the diverse transfer student body. The Wright-IIT Engineering Program's articulation agreement was drafted and approved by both institutions. It contains all the stipulations agreed upon during the Program design, including a well-defined set of requirements and benefits, the cohort model with prescriptive and rigorous curriculum aligned to IIT, and the commitment to improve the curriculum.

### **3.2. Implementation**

In Fall 2019, the first cohort of the IIT-Wright Engineering Program was implemented. Fifty-two (52) students were admitted to the inaugural cohort with ninety-five percent (95%) Fall-to-Fall retention. Twenty-two (22) students transferred or will transfer to IIT and ten (10) students transferred or will transfer to other engineering school within two (2) years from admission. Additional fourteen (14) students will be transferring after 2.5 to 3 years, with a projected transfer



rate of eighty-eight percent (88%) to engineering within three years. Seven percent (7%) of students opted out from engineering and are transferring to other majors. For the first year of implementation, the HPAT model implemented by IIT-Wright is projected to have a combined transfer rate (engineering and non-engineering) of ninety-five percent (95%) (Figure 2). All students will also complete an associate degree before transfer.

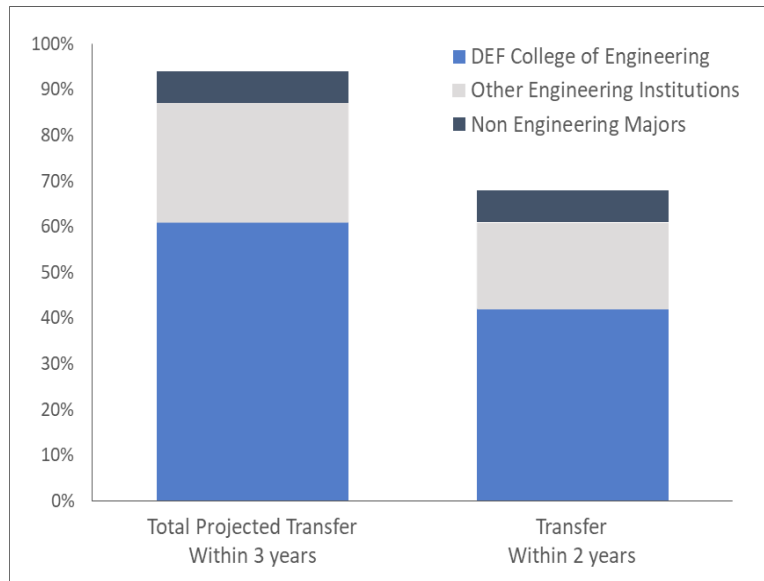


Figure 2. HPAT Model: IIT-Wright Engineering Program’s First Cohort Transfer Rate. A combined 95% of students are projected to transfer within three years from initial admission. Sixty-two percent (62%) are transferring to the Armour College of Engineering at IIT and other engineering institutions after two years. An additional twenty seven percent (27%) are projected to transfer after 3 years.

### 3.3. Evaluation

The majority of the students in the IIT-Wright Engineering Program participated in the survey and case study interviews. Appreciative Inquiry [19] was used for the Case Study interviews in collaboration with an external evaluator, MUSE consulting. Students in the cohort unanimously reported that the Program makes them belong to engineering (results not shown). The Case Study results have already precipitated modification in the implementation of the program, and the addendum to the articulation agreement.

## 4. DISCUSSION

### 4.1. HPAT MODEL: IIT-WRIGHT ENGINEERING PROGRAM

The HPAT model requires commitment and collaboration within and between institutions at every stage of the program. Under this model, the community college’s and the 4-year transfer institution's faculty, administration and staff are expected to work synchronously and collaboratively to deliver the best college experience from the point of admission at the community college, through transfer, and up to bachelor's or master's degree completion.

The success experienced by the IIT-Wright Engineering Program in its first-year of implementation was possible due to a well-thought-out program design supported by a comprehensive articulation agreement, and driven by a strong institutional commitment for implementation of best practices contextualized to the students' needs. These elements are necessary for the sustained success of the program.

By applying the HPAT model, the Program has established a well-integrated and aligned approach to information sessions, orientation and enrollment, placement testing, remediation, curriculum, enrichment opportunities, instruction, assessment, and academic and financial support. Combined efforts of both institutions has played a significant role in encouraging high school students and their parents to consider the programmatic transfer program as a viable option for their education. Marketing and communication teams have developed the program brand visible in both institutions' website and marketing materials. The 4-year institution refers students to the Program when necessary. The individualized guided pathways are shared across institutions, thus eliminating confusion. Advisers, faculty, and academic mentors speak the same information and support each other, providing excellent advising and mentoring to students.

By implementing the best practices contextualized to the unique needs of students, IIT-Wright Engineering Program is positioned to transfer 95% of students (Figure 2). This would not be possible without the collaboration and commitment within and between institutions. Contextualized interventions designed by Wright College to address specific academic, financial, socialization and adjustment barriers to students' success are summarized in Table 1. Implementation of some of these practices at IIT ensures that students will be supported and feel they belong when they transfer. It is expected that students in the program will transfer with the same level of academic preparation as students who directly enrolled at IIT in their first year. This is accomplished by the commitment to academic rigor and aligned curriculum including content, which is a very important and characteristic feature of the HPAT model. It aims to prevent students from being academically disadvantaged when they transfer, preventing additional stress and longer time to graduation. Figure 2 shows that 61% of students in the program will transfer as juniors after two years at Wright College with the same academic preparation as students enrolled at IIT from their freshman year. This very high transfer rate after two (2) years from the initial enrollment in the program is one of the most significant outcomes that distinguishes the HPAT model from other articulation agreements.

The required quality of the HPAT model promises success at the transfer institution which will be longitudinally tracked. It is also important to note that students accepted in the HPAT model are mostly underprepared (students who need remediation), suggesting that the HPAT model provides an equitable approach to education and provides students second chance opportunities with high likelihood of success.

In addition, HPAT model facilitates finding the major discipline or a degree program in which student's likelihood of succeed increases. Seven percent (7%) of students in the first cohort have changed their major, yet these students are still retained and are positioned to transfer within three years. The early identification of the major, rigorous curriculum, setting high expectations and early exposure to professionals, provides students with options and opportunities to identify an appropriate path to a terminal degree that suits their passion and wastes no time and resources.

### Academic Barriers

- Engineering Summer Bridge for near-STEM ready students intentionally designed to prepare students for a rigorous engineering and computer science curriculum. [12]
- Pre-Engineering semester as a remediation for Math, Chemistry and English curriculum. [11]
- Cohort model with prescriptive and rigorous curriculum aligned to transfer institution.
- Course sequences adjusted to different academic and preparedness levels of incoming students.
- Intentional advising to address the academic needs of a diverse student body
- Mandatory tutoring

### Financial Barriers

- Guaranteed transfer scholarships: *i.e.* \$25,000 annually plus a one-time \$5,000 transfer scholarship at IIT
- Student work opportunities as program tutors, ambassadors, and near-peer mentors
- Professional and research internships provided through the industry and academic partners
- Access to career services such as career fairs and career counseling at both institutions
- Dual-admission/co-enrollment with option to take classes at transfer institution at discounted tuition rate and shortening time to graduation by transferring with junior standing. [24]
- Engineering Summer Bridge to shorten/eliminate financial cost of taking remediation classes, and to decrease time to graduation. [11]

### Socialization and Adjustment Barriers

- Engineering Summer Bridge to increase students' sense of self-efficacy and foster a community of practice (CoP) [21].
- Cohort model to create a community of learners to support one another and to act as mechanisms for increasing student interaction, interdependence, and retention. [25]
- Near-peer mentoring to counteract difficulties acquiring a sense of community at the transfer institution [12, 15]
- Faculty and Professional mentoring
- Memberships in professional organizations to develop leadership skills and Community of Practice (CoP).
- First Year Engineering Seminar course with industry speakers to enhance the first-year experience, to increase a sense of belonging in the profession, to choose the major, and to build professional network.
- Zero credit, program specific course "Engineering 101" developed and offered at the 4-year transfer institution to build a sense of community and identity at transfer institution.
- Access to resources at transfer institution such as the library, student clubs, and the gym, while still at community college to increase a sense of belonging and seamless transition.

Table 1. HPAT model incorporates best practices and contextualized interventions to address barriers to success.

## **4.2. Criteria for Duplication**

No two institutions are completely alike with regards to their policies and practices. Colleges exhibiting the most progress with Guided Pathways have devoted a great deal of time and effort to laying the groundwork for necessary reforms [8]. The HPAT model is more complex, requiring major changes to institutional practices and culture. The number one criterion for the program development is the creation of a team whose expertise can be combined to design a holistic program centered on the needs of transfer students from admission at the 2-year institution to bachelors' or masters' degree completion at the transfer institution. The team has to work together to make sense of the institutional data, current practices, culture, and policies, and be willing to put together a holistic and programmatic design for implementation.

Each institution is unique, so a complete reproduction of the model is difficult but doable. To duplicate the HPAT model successfully, both institutions must understand the amount of additional work needed and to provide institution commitment to the model. The most important criterion for the successful design and implementation of the HPAT model, by any set of partner institutions, is to contextualize the program design including the articulation agreement according to students' unique needs. A generalized articulation agreement will not be sufficient. The contextualization process requires a thorough understanding of the student population and recognition of the visible and invisible barriers to student success at specific institutions. Table 1 outlines the some of the barriers that prevent students' success. It also summarizes the best practices contextualized to address such barriers. All of these practices were successfully contextualized for the IIT-Wright Engineering Program students. These practices can be made intentional to the institutions that wish to adopt the model. Regardless of the practices to be implemented, it is necessary that the changes are designed to the unique characteristics of students. It is also essential that the 4-year transfer institution is actively involved early in the process of implementation to streamline transition and continuously support students after they transfer. The authors recognize that the HPAT model demands a lot of time to design and to implement. However, the benefits are worth the time, the resources and the institutional commitment.

## **5. FUTURE WORK**

We have conceived a novel model to student transfer, described the development process, reported on the outcomes of its first year of implementation, and gathered data from the community college up to the transfer of the first cohort. As part of the immediate future work, the IIT-Wright Engineering Program will implement contextualized interventions at IIT and track the first-year cohort success up to bachelors' or masters' degree completion. The second year of implementation data will also be incorporated. Development efforts will continue by augmenting the number, the type of curricular and other enrichment, and programmatic opportunities offered to transfer students at both institutions. The survey and case study interview results will be correlated with quantitative data. Based on the combined qualitative and quantitative data, the program will be continuously improved including additional possible addendum to the articulation agreement. To further assess the viability of the Program, Wright College will lead the expansion of the HPAT model at its sister colleges and will implement the model at another 4-year transfer institution. Similarly, IIT will explore implementing the model at another 2-year partner institution(s) and the expansion to disciplines other than engineering.

## ACKNOWLEDGMENT

J. Waranyuwat, B. Haffercamp, S. Lemons, J. Mandolini, M. Bauer, J. Alvarado, Wright College Engineering Team (L. Huertas, M. Llopiz, S. Calabrese, G. Baird, K. Jones, M. Haptas, B. O'Connell), M. Angara and in memoriam: Melissa Mercer-Tachick- MUSE Consulting



This material is based upon work supported by the National Science Foundation under Grant No. DUE-1832553. Any opinions, findings, and conclusions or recommendations expressed in these materials are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

This research is approved by City Colleges of Chicago IRB protocol 108007.

## REFERENCES

- [1] J. P. Freeman, "Community Colleges in Higher Education: The Role of Community Colleges in Serving the Underserved Student," *Planning for Higher Education*, vol. 35, no. 3, pp. 56-62, 2007.
- [2] S. Mintz, "Inside Higher Ed, Community Colleges and the Future of Higher Education," 9 March 2019. [Online]. Available: <https://www.insidehighered.com/blogs/higher-ed-gamma/community-colleges-and-future-highereducation#:~:text=Community%20colleges%20are%20the%20cornerstone,%2Dgeneration%2C%20and%20older%20students.> [Accessed 1 January 2021].
- [3] "Enrollment in Undergraduate Education," ACE, Race and Ethnicity in Higher Education, [Online]. Available: [https://www.equityinhighered.org/data\\_table\\_category/enrollment-undergraduate/](https://www.equityinhighered.org/data_table_category/enrollment-undergraduate/).
- [4] L. Knapp, J. Kelly-Reid and S. Ginder, "Enrollment in Postsecondary Institutions, Fall 2010; Financial Statistics, Fiscal Year 2010; and Graduation Rates, Selected Cohorts, 2002-07. First Look," National Center for Education Statistics, 2012.
- [5] G. Mooney and D. Foley, "Community Colleges: Playing an Important Role in the Education of Science, Engineering, and Health Graduates," *NSF*, vol. 11, no. 317, pp. 1-6, 2011.
- [6] D. Shapiro, A. Dunder, F. Huie, P. Wakhungu, X. Yuan, A. Nathan and Y. Hwang, "Tracking Transfer: Measures of Effectiveness in Helping Community College Students to Complete Bachelor's Degrees (Signature Report No. 13)," Herndon, VA, National Student Clearinghouse Research Center, 2017.
- [7] T. U. O'Banion's, *13 Ideas that Are Transforming the Community College World*, Rowman & Littlefield Publishers, 2019.
- [8] D. Jenkins, H. Lahr and J. Fink, "Redesigning Your College Through Guided Pathways: Lessons on Managing Whole-College Reform From the AACCC Pathways Project," Teachers College, Columbia University, New York, 2019.
- [9] T. Bailey, S. S. Jaggars and D. Jenkins, "Redesigning America's community colleges: A clearer path to student success.," Harvard University Press, Cambridge, 2015.
- [10] T. Bailey, S. S. Jaggars and D. Jenkins, "What we know about guided pathways," Columbia University, Teachers College, Community College Research Center, New York, NY, 2015.
- [11] P. Gandara, E. Alvarado, A. Driscoll and G. Orfield, "Building Pathways to Transfer: Community Colleges That Break the Chain of Failure for Students of Color," Civil Rights Project / Proyecto Derechos Civiles, Los Angeles, 2012.
- [12] D. J. Espiritu and R. Todorovic, "Increasing Diversity and Student Success in Engineering and Computer Science through Contextualized Practices", Paper presented at 2020 ASEE Virtual Annual Conference Content Access, Virtual On line <https://peer.asee.org/34817>

- [13] G. M. Walton and G. L. Cohen, "A Question of Belonging: Race, Social Fit, and Achievement," *Journal of Personality and Social Psychology*, vol. 92, no. 1, pp. 82-96, 2007.
- [14] A. Doherty, "Peer Mentoring and Professionalism," in HEA STEM Conference, 2013.
- [15] P. Reddy and P. Hill, "Undergraduate Peer Mentoring: An Investigation into Processes, Activities and Outcomes," *Psychology Learning & Teaching*, vol. 6, no. 2, pp. 98-103, 2007.
- [16] P. Wilcox, S. Winn and M. Fyvie-Gauld, "It was Nothing to do with the University, it was Just the People': the Role of Social Support in the First-Year Experience of Higher Education," *Studies in Higher Education*, vol. 30, no. 6, pp. 707-722, 2005.
- [17] H. Kalamkarian, M. Karp and E. Ganga, "What We Know About Technology-Mediated Advising Reform," *Community College Research Center/ Teachers College, Columbia University*, 2017.
- [18] "Education Commission of the States (ECS)," 2021. [Online]. Available: <http://ecs.force.com/mbdata/mbprofallrta?Rep=TA20STA>.
- [19] A. N. L. H. Jan Reed, *Appreciative Inquiry: Research for Action in Handbook of Research on Information Technology Management and Clinical Data Administration in Healthcare*, Hershey, PA: IGI Global, 2009, pp. 631-645.
- [20] J. Lave and E. Wenger, *Situated Learning: Legitimate Peripheral Participation*, Cambridge University Press, 1991.
- [21] A. Bandura, "Self-efficacy mechanism in human agency," *American Psychologist*, vol. 37, no. 2, p. 122-147, 1982.
- [22] E. Wenger, *Communities of Practice: Learning, Meaning, and Identity*, Cambridge University Press, Cambridge, 1998.
- [23] M. C. Loui, "Ethics and the Development of Professional Identities of Engineering Students," *Journal of Engineering Education*, vol. 94, no. 4, pp. 383-390, 2005.
- [24] T. Kelley and J. Knowles, "A conceptual framework for integrated STEM education," *International Journal of STEM Education*, vol. 3, 2016.
- [25] "The Condition of Education: Undergraduate Enrollment," NCES, 2020.
- [26] G. Crisp, "The Influence of Co-Enrollment on the Success of Traditional Age Community College Students," *Teachers College Record Volume*, 2013. [Online]. Available: <https://www.tcrecord.org>. [Accessed 19 2 2021].
- [27] H. Washington, J. Pretlow and C. Mitchell, "The Difference a Cohort Makes: Understanding Developmental Learning Communities in Community Colleges," *Journal of College Student Retention: Research, Theory and Practice*, vol. 12, no. 2, pp. 225-242, 2010.