
AC 2012-3558: SUCCESS OF JOINT PROGRAMS BETWEEN JUNIOR AND SENIOR COLLEGES

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Success of Joint Programs between Junior and Senior Colleges

Abstract

While the demand for highly skilled engineers is greatly increasing, minorities and women are not well represented in the engineering workforce due to inadequate secondary school preparation, the absence of academic support at many institutions, lack of academically intensive summer programs, and financial constraints, among others. Community colleges address many of the complex issues surrounding the under-representation of women and minorities in engineering by offering low tuition and a regular schedule of the remedial courses, as well as an array of support services such as tutoring, supplemental instruction, and mentoring. Joint/Dual (JD) programs between junior and senior colleges offer increased educational opportunities for underrepresented minorities in science and engineering fields who might otherwise be denied access to higher education. These programs are designed to provide students from junior colleges with the same curriculum as the first two years of an ABET-accredited engineering program at a senior college. Students entering the programs are granted dual admission to the community college as well as the senior college. Upon successful completion of the lower division courses and degree requirements for an Associate in Science (AS) degree in Engineering Science at a community college, students seamlessly transition to the upper division of the baccalaureate engineering program at a senior college. This paper discusses the advantages and disadvantages of the JD programs as well as a preliminary analysis of the success of the programs. Data from the JD program where students attend both the community college and the senior college at the same time for the first 2 years of their undergraduate study show that 44% of students graduated from the community college with an AS degree and a relatively high GPA average of 3.13. Community college retention rates were relatively high for the first 2 years, indicating that students in the JD program have the necessary tools and support to remain in the program. Although 92% of those who graduated with an AS degree intended to matriculate at the senior college, only 53% actually took courses as a senior college student for at least one semester. Senior college retention rates were relatively high compared to retention rates for transfers from other community colleges into the major urban University system, indicating that once JD students make the transition from the community college, they are more likely to be retained than those who did not receive the same support and advantages as students in the JD program. Academic performance using semester GPAs shows that once students overcome the difficulty of adjusting to the senior college, their GPAs improve and they may be more likely to graduate. More data, especially from JD students who reach the senior college, are needed to fully assess the success of the JD program.

Introduction

While the demand for highly skilled engineers is greatly increasing, minorities and women are not well represented in the engineering workforce due to inadequate secondary school preparation, the absence of academic support at many institutions, lack of academically intensive summer programs, and financial constraints, among others [1]. Numerous programs exist to recruit minority students into higher education [2]. Among these are early intervention programs, such as summer bridge programs; education and mentorship programs initiated by professional associations and private or government organization, dual or concurrent enrollment programs between high schools and community colleges; pre-college programs to attract students to specific careers such as Precollege Initiative for Minorities in Engineering; school-college collaborative partnerships between community- or four-year colleges; and other academic outreach programs.

Community colleges address many of the complex issues surrounding the under-representation of women and minorities in engineering by offering low tuition and a regular schedule of the remedial courses, as well as an array of support services such as tutoring, supplemental instruction, and mentoring. However, the transition from a two-year program to a four-year program can sometimes be difficult for students, particularly those students from traditionally underrepresented groups. Transfer students are likely to experience a complex adjustment process: academically, socially, and psychologically, because of the environmental differences between two- and four-year institutions. Factors that can deter the success of minority transfer students include unclear policies regarding college transfer and articulation policies; lack of centralized and easily accessible source of information at the senior college; inadequate advising structure, especially during the first year of transfer; level of institutional performance assessments; and inadequate cross-cultural communication [3]. In addition, community college transfer students are less likely to be engaged (develop their own social networks) in the four-year institutions into which they transfer than native students [4], further decreasing their chances in succeeding at senior colleges. Robust and fluid articulation agreements and collaboration between faculty of the two-year and four-year schools [Townsend, 2011], communication, trust, and mutual respect between institutions [6,7], and providing awareness of the expectations of the four year school [8] are essential in developing a fluid system that allows students to progress from one higher education program to the next..

Joint/dual programs between junior and senior colleges can fulfill this role. These programs are designed to provide students from junior colleges with the same curriculum as the first two years of a program at a senior college. Students entering the programs are granted dual admission to the community college as well as the senior college. Joint/dual programs should not be confused with dual enrollment programs between high schools and colleges in which high school students (usually juniors and seniors) are permitted to enroll in college courses [9].

This paper discusses the challenges and possible approaches to addressing challenges in early registration processes, transfer course evaluations, tracking and advisement, maintaining curriculum alignment, and retention of students who transfer from junior to senior colleges. Students' performance at their community college is compared to their overall performance once they reach higher division courses at the senior college. Trends in GPAs, number of credits

taken, and probation status are used as metrics to evaluate the overall performance of students in the JD program. Other analysis involve comparing performance and retention rates of students in the JD program to transfer students from the other community colleges who did not complete their AS degrees.

Background

Several colleges and universities in the US have established joint programs between junior and senior colleges to foster an effortless transition from 2-year programs to 4-year institutions while allowing students to earn two degrees, the associate's and the bachelor's degrees in a cost-effective manner. The need for collaboration among these institutions spans a wide range of majors and academic programs. Among these are: the Dual Admissions program in Philadelphia, the Dual Degree Programs in New Jersey and Illinois, the Joint Admission Programs in Massachusetts, Western New England, and Eastern Iowa, the NCC/C.W. Post Joint Admissions Program, and the Joint Agreement programs in Illinois where students commit to completing the associate's degree at a community college and maintain a minimum GPA in exchange for automatic admission to the senior college and financial incentives and support services. The University of Houston joint admission partnerships with area community and junior colleges and the 2+2 agreements at Onondaga Community College in upstate New York admit their students to both institutions while the student is attending the community college. In addition to guaranteed acceptance to the four-year college, students in these programs enjoy other benefits such as advising from senior college counselors, library privileges, access to computer labs, locked-in tuition rates for four years, application fee waivers, invitations to special campus events, and priority on-campus housing. However, not all programs are open to part time students or those who transfer credits from other institutions.

Some four-year institutions have developed applied baccalaureate programs specifically designed to incorporate the associate of applied science degree [10]. Applied baccalaureate programs treat lower-division technical courses as valid courses that can count as part of the major field of study. Additionally, the upper-division courses required for completion of the applied baccalaureate typically include a high number of general education courses, which in the traditional baccalaureate degree are considered lower-division course work. The degree may be offered by traditional baccalaureate degree-granting institutions or by associate degree-granting colleges, including public, private, and proprietary institutions. Articulation agreements for these degrees count technical courses taken at community colleges as courses for the major. Transfer students with associate of applied science degrees are required to take more courses in the major and enough general education courses to meet the state's or the four-year institution's general education requirements.

The Joint Undergraduate Engineering Program in Missouri provides a unique opportunity to non-traditional students in a metropolitan area to engage in undergraduate engineering education by providing a flexible schedule. The upper-division engineering courses are offered in the evenings and on Saturdays; this schedule permits students to co-op during the day at local engineering firms. Students are admitted to the upper-division program after they have completed an acceptable pre-engineering program, taken at a partner institution or at a community college in

the area. Other major-specific programs, such as the transfer associate degrees in Washington State, allow students to transfer a “package” of coursework to baccalaureate institutions [11]. The Direct Transfer Agreement (DTA) allows students to complete general education requirements whereas the Associate of Science Transfer (AS-T) degree provides more direction for students to transfer into a variety of science majors. The major-specific transfer program has shown to be more successful than the DTA program. Students taking the AS-T transfer to baccalaureate institutions at a higher rate than students who take the more general DTA and concentrate on science and engineering. AS-T graduates are more likely to earn a bachelor’s degree than students who follow the DTA curriculum.

Based on data gathered by some joint/dual programs, it appears beneficial to provide students with a major-specific curriculum at the community college level. This provides a more direct path for degree completion and can result in higher retention and graduation rates. In this paper, we investigate the success of one such program between junior and senior colleges in the highly specific area of Engineering.

Overview of programs with community colleges at a major urban University

Three types of articulation programs between junior and senior colleges exist at a major urban university: a standard articulation agreement and two joint/dual programs.

Standard Articulation Agreement

Articulation agreements are a means of standardizing the transfer process and enhancing students’ chances of movement through the educational pipeline. Course equivalencies are usually determined by the school of destination, including the type of course and the number of credits that will be granted. These standard articulation agreements exist between the only senior college in a major urban university with a school of engineering and other junior and senior colleges within the university system.

Joint/Dual Programs

The Joint/Dual (JD) programs between two junior colleges and one senior college within a major urban University system offer increased educational opportunities for underrepresented minorities in science and engineering fields who might otherwise be denied access to higher education. Created in 2002, these programs are designed to provide students from junior colleges with the same curriculum as the first two years of an ABET-accredited engineering program at a senior college [12]. Students entering the programs are granted dual admission to the community college as well as the only senior college in the University system with a School of Engineering. Upon successful completion of the lower division courses and degree requirements for an Associate in Science (AS) degree in Engineering Science at a community college, students seamlessly transition to the upper division of the baccalaureate engineering program (Civil, Electrical, Chemical, or Mechanical Engineering Science) at a senior college. Two such programs exist at a senior college in a major urban university:

1. A program where students attend the community college for the first 2 years, and upon completion of the AS degree continue their last 2 years at a senior college;

2. A program where students attend both the community college and the senior college at the same time for the first 2 years.

With the senior college just a short bus ride away (1.4 miles), students in the joint/dual program have easy access to both campuses. This allows them to take courses at the senior college that are not offered at the junior college for a variety of reasons. These may include inadequate enrollment in specialized engineering courses, lack of specialized faculty to teach the courses, or lack of adequate teaching and laboratory facilities and equipment. The benefits to students, following the community college track, taking courses at a 4-year college are significant. In a recent report, studies have demonstrated that community college students who were likely to persist and complete a degree, tended to be in a collegiate track that required them to transfer to a 4-year college to attain a bachelor's degree [13]. Along with an increase in persistence, a community college student who takes courses at a 4-year institute while still a student at the 2-year school is in a better position to reduce the negative impact of the culture change.

Advantages of the programs

Students in the JD program have the same rights and responsibilities as current senior college continuing students. In addition, JD students receive special attention before they transition to the senior college.

Special orientation and advisement session

Students in the JD program are invited for a specially convened orientation and advisement session ahead of early registration for the next semester. The orientation session includes introduction of key administrative personnel in the school of engineering, Q & A with former JD students, brief discussions regarding financial aid, health and wellness, college policies and procedures, and finally advisement and registration for courses.

Early registration

Students that are in good academic standing and have all necessary requisites are allowed to register for the next semester's courses during the early registration period at a senior college. The senior college invites all students in the Joint/Dual program for orientation and registration for the next semester.

Registration for courses on permit

Joint/Dual students are allowed to take certain required engineering courses on permit at the senior college in order to satisfy the requirements of the AS Degree. Students that are in good academic standing and have all necessary requisites are allowed to register, via e-permit, for engineering courses at a senior college during the early registration period. The online permit process allows students to make arrangements to take courses at other colleges without having to contact directly both the home and host colleges for approval. This process provides a convenient means of obtaining permission to register for courses offered at other colleges, enhances the opportunity of graduating in a timely manner, and allows students to pursue academic interests not offered at their home college.

Application fee waiver

Unlike all other transfer students, JD students are waived all application and processing fees associated with transferring from a junior to the senior college.

Straightforward transfer credit evaluation

The alignment of courses between the junior and senior colleges creates an easy, quick, and straightforward process for transfer credit evaluation

Disadvantages and challenges

The issues and challenges that must be overcome in creating a successful joint/dual program between 2-year and 4-year institutions include curriculum, infrastructure that supports the students and the program as a whole, and communication.

As in any academic program, the development of a cohesive curriculum is important, particularly when the program extends across departments, learning environments and academic institutions. The perspective of the community college on curriculum and the transferability of courses can be quite different from that of the 4-year institution. During the process of developing an articulation agreement, it is not unusual for the community college to ask for a number of core pre-engineering courses (e.g., calculus, physics, chemistry, Engineering Design) that the community college student could use to transfer into the engineering (and computer science) program/s at the 4-year institution. These core courses are selected so as to reflect the first two years of a four-year engineering program. While this model is certainly reasonable, it does have some major weaknesses. Many engineering schools have engineering programs in classic areas such as civil, chemical, electrical and mechanical engineering with a number of courses, in mathematics and science, in common. However, the first two years of an engineering program can have subtle but significant differences in course requirements that are specific to that major. If the new transfer student stays on track with their initial choice for a major, there is no problem. But, should the student decide to change majors when transferring to the 4-year institution, that decision could cost them time and money and it could have a negative impact on their motivation to attain the bachelor's degree.

The variation in the curriculum of the first two years of engineering programs may become greater as more areas of studies in engineering grow, as colleges and universities respond to the growth in technology and its application. The one size fit all theme of the core pre-engineering course model for articulation agreements would not be ideal when addressing the issue of different course requirements in the first two years of different engineering majors. The core pre-engineering course articulation model can also be problematic when advising transfer students. Since, the pre-engineering courses are not aligned with a specific area of study or major, there is the opportunity for the misinterpretation of which group of courses belong to a given major, which could ultimately lead to the student being misadvised and taking courses they do not need.

Differences in credit assignment pose additional challenges for JD programs. For example, the number of credits earned for a particular course at a community college may be less than the number of credits that course is given at the senior college. Faculty and administrators at a

community college may feel that it is unfair to take away credits earned by students who started the program at the community college. When viewed from that perspective, it may appear that courses at a senior college are better and worth more than those at the junior college. It is only through open discussions between faculty and administrators from both colleges that an agreement on such curricular issues can be achieved [Walser, 2004].

Introduction of new courses into the JD curriculum can be difficult since both the junior and senior colleges need to be aware of the changes and additions to the curriculum. The senior college requires an extensive approval process if a junior college wishes to introduce courses into their curriculum. This process involves approval by the senior college's curriculum committee, and department chairs and faculty. Syllabi for new courses are exchanged along with ideas about upcoming changes in the curriculum. This important part of the process insures that the curriculum is current and helps to establish a relationship between the two schools that extends beyond the office of the deans. It also strengthened the relationship between the two schools

Communication between two- and four-year transfer partners is critical to second-level articulation. Successful transfer partners communicate frequently, visit each other's campuses, meet frequently to discuss curricular changes, and even share faculties [14]. Currently, communication between two-year and four-year faculty members varies from campus to campus and department to department, often depending on personal relationships among faculty members or administrators. The pertinent details of the JD program agreement need to be promulgated from advisor to student, administration to student, academic division to academic division, and 2-year college to 4-year college and back. Having a clear and concise document, for each engineering track, detailing explicitly the courses, the course sequences and degree requirements from the community college and the senior institution, can go a long way to reduce any confusion an engineering student or an academic advisor might have about the path to attaining an engineering bachelor degree.

Another challenge includes limited access to student's records. Advisors on both campuses need access to student records on the other campus to keep track of student's academic performance, progress towards degree completion, and registration status, particularly for those students who take courses on both campuses. Differences in student information systems and specific login requirements prevent advisors from accessing important student data. Unification of the online systems or easy sharing of login information can solve this problem.

Methods and Data Analysis

In order to determine the success of the current JD programs at a major urban University system, data on student retention, graduation, and performance were obtained from both the junior and senior colleges. We focused on the JD program where students attend both the community college and the senior college at the same time for the first 2 years of their undergraduate study. Data from this program were most complete and contained information such as GPAs and number of credits attained at both the junior and senior colleges. Data were available for students in the JD program from Spring 2005 to Spring 2011. These students majored in Civil, Chemical, Mechanical, and Electrical Engineering.

Overall

Overall success of the JD program was determined by calculating the percent of students retained in the following 4 categories:

1. Students starting out at the community college
2. Students graduating from the community college
3. Cumulative GPAs for community college students in 2 categories:
 - Those who attained an AS degree
 - Those who did not attain an AS degree
4. Students transitioning to the senior college
5. Students graduating from the senior college

Community College

Student data from the community college were grouped according to cohort, defined as the year each student graduated from the community college. The following metrics were calculated for students in the JD program at the community college:

1. 4-year retention rates
2. Percent of students who graduated with an AS degree

Senior College

Student data from the senior college were grouped according to cohort, defined as the year each student entered the JD program at the senior college. The following metrics were calculated for students in the JD program during their first year of study at the senior college:

1. 4-year retention rates for students in the JD program
2. 4-year retention rates for transfer students not in the JD program with AS degrees
3. 4-year retention rates for transfer students not in the JD program with without AS degrees
4. Average GPAs based on semester retained

Results and Discussion

Overall

Data on 131 students were used to determine the success of the JD program. The majority, 81 students, were EE majors, 23 were CE, 15 were CHE, 2 were ME, and 8 were undecided. Due to the relatively small number of JD students, no attempt was made to separate results by major. Out of the total 131 students, 44% (60) graduated from the community college with an AS degree. The average GPA for those who obtained their AS degree was 3.13 (standard deviation 0.42), versus 2.46 (standard deviation 0.66) for those who did not graduate within at least 4 years. Poor academic performance appears to have played an important role in retention and graduation from the community college.

Out of those 60 students, a majority, 92%, intended to continue their undergraduate study at the senior college (determined using their admission status to the senior college), but only 32 of those students (53% of those who graduated with an AS degree) actually took courses as a senior college student for at least one semester. To date, only 2 students who have started in the JD program at a community college have graduated from the senior college. This low number can

be explained by the fact that the majority of these students are still in the process of obtaining their degree at the senior college.

Community College

Retention rates were calculated on a 4-year basis for students in the JD program based on the semester when they first became students in the JD program. As Figure 1 shows, retention rates drop drastically after the 2nd year in the program. For most cohorts, 1-year retention rates are relatively high, from 81-100% (the 2010 cohort shows very low 1st year retention rates, although the number of students was low, therefore interpretation of this number should be limited); 2nd year retention rates drop to between 35-86%, and 3rd year retention rates are even lower, 18-45%. By the 4th year, those students who have not already graduated were retained only at around 4-13%. The relatively high rates of retention, especially for the first 2 years indicate that students in the JD program have the necessary tools, support, and wiliness to remain an Engineering student.

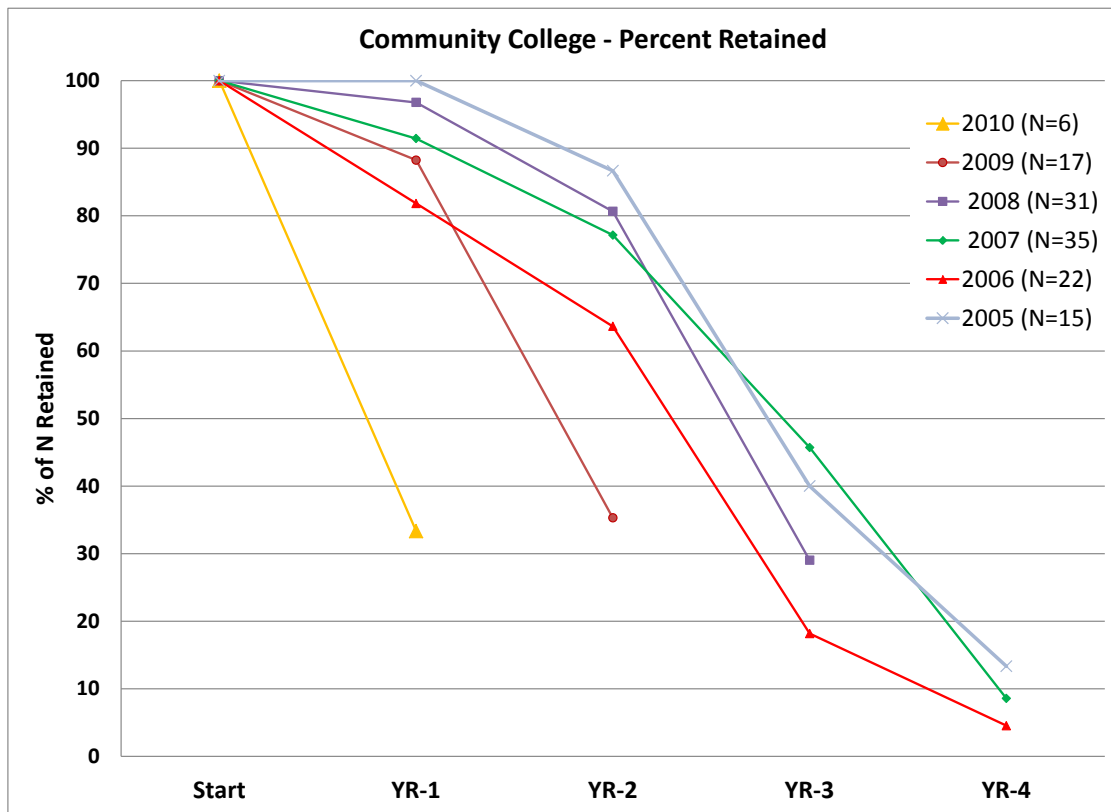


Figure 1. 4-year retention rates for JD students at the Community College.

Graduation percentages for the community college varied from cohort to cohort, with highest rates at 61.3% for the 2008 cohort, then 45.7% for the 2007 cohort, then 40.0% for the 2005 cohort, and 36.4% for the 2006 cohort, with lowest graduation rate of 23.5% for the 2009 cohort. It is not clear why different student cohorts experienced varied retention and graduation rates, especially given that no specific trend emerges. It is possible that the relatively small number of

students in the Joint/Dual program may not be enough to determine overall graduation and retention trends. In addition, separation of graduation and retention rates by major can yield answers as the reasons behind varying percentages. The four majors within the JD program, Civil, Chemical, Mechanical, and Electrical Engineering have varying requirements at the community college level, with some majors, such as Civil Engineering requiring students to take Civil Engineering courses at the senior college as part of their requirements for the AS degree. Inability to pass courses at the senior college may prevent students from graduating and being retained at the junior college. Larger number of students in each major is required to determine what specific factors cause varying graduation and retention rates.

Senior College

As stated above, 53% of students in the JD program who graduated with an AS degree matriculated at the senior college for at least 1 semester. It is not possible to determine the exact reasons behind this statistic, but a closer look into the academic performance of these students at the community college reveals that their already poor performance there may have played a role in their not continuing at the senior college. Many of the student who chose not to continue at the senior college took Engineering courses at the senior college while still finishing their AS degree. Grades in these courses were usually low, thus contributing to an already starting low GPA at the senior college.

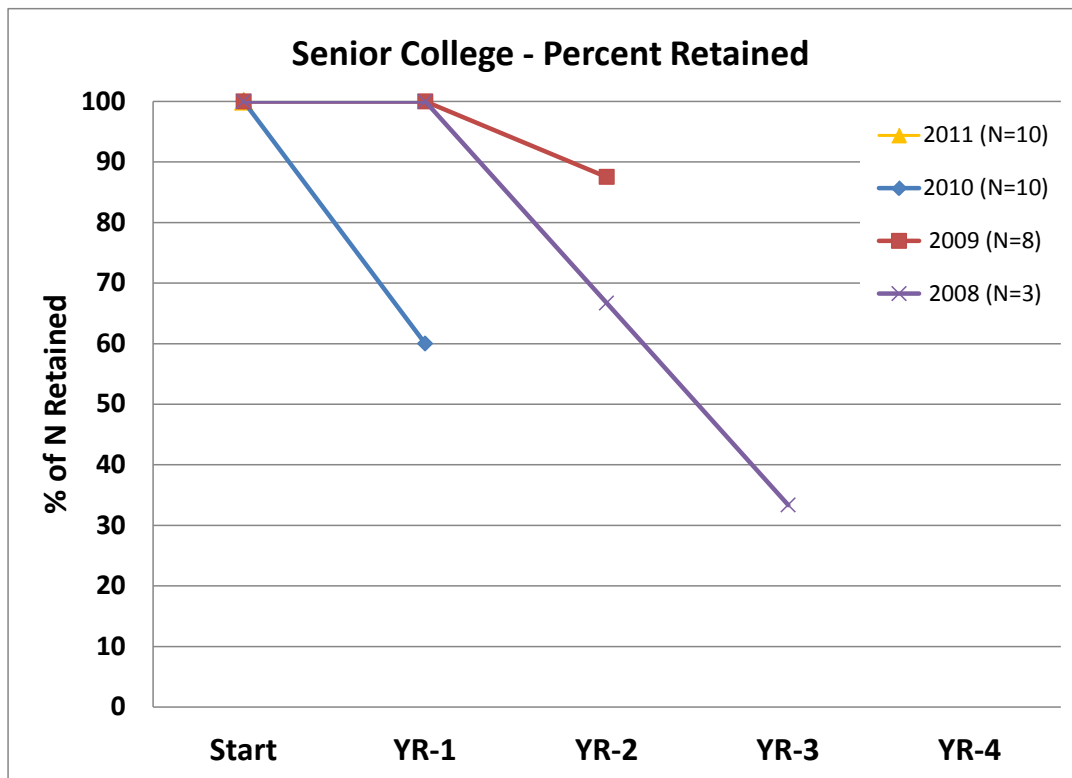
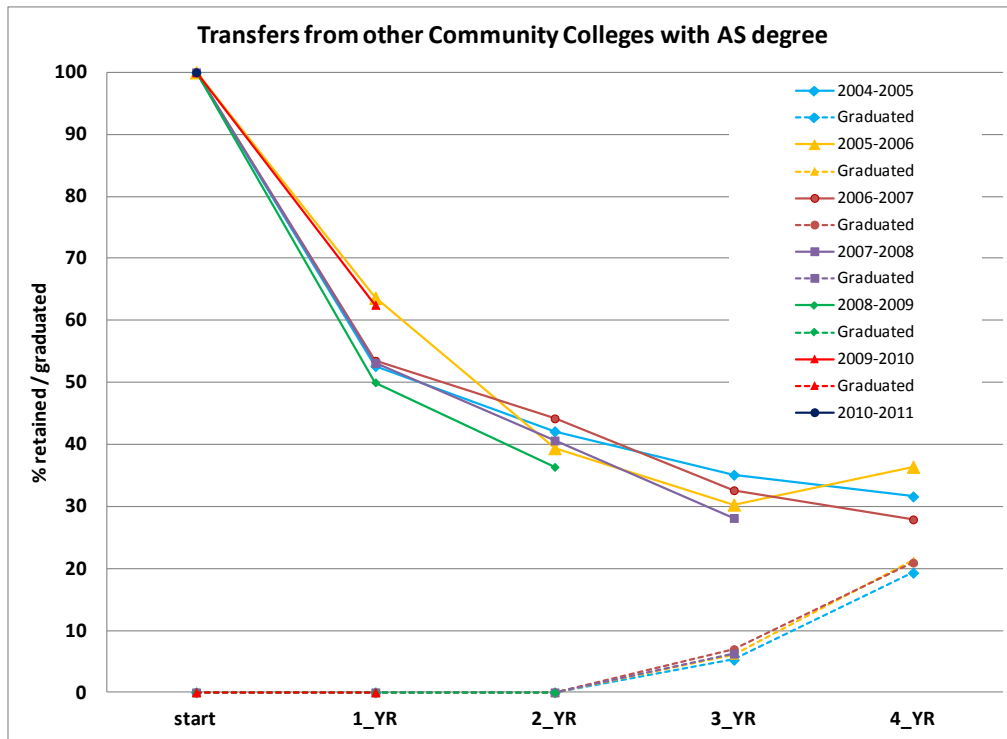


Figure 2. 4-year retention rates for JD students at the Senior College.

For the 32 students who matriculated at the senior college for at least one semester, retention rates were calculated based on the semester for which they entered the senior college. There was only 1 person who matriculated in 2007, therefore that is now shown in the figure 2. Retention rates were relatively high, from 60-100% for the first year, and 66-87% for the second year. Compared to the first and second year retention rates for transfer students who have or have not attained an AS degree from other community college and matriculated into the major urban University system (Figures 3a-b), the high retention rates for JD students indicate that the additional support JD students receive contributes to them being retained.



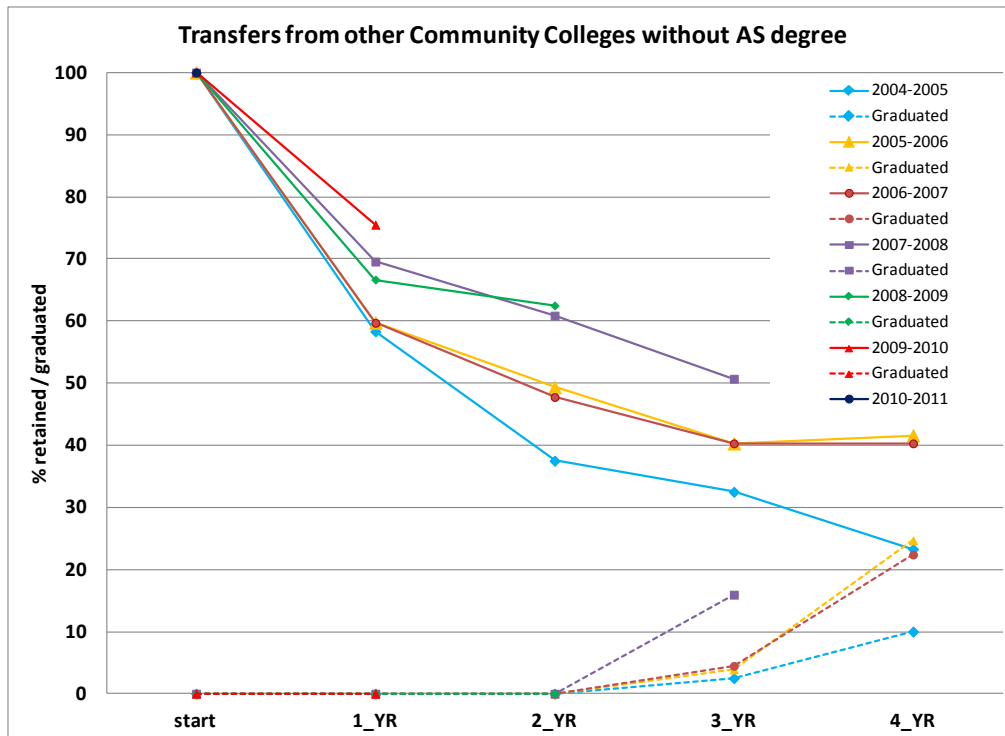


Figure 3a-b. 4-year retention rates for students who transferred from community colleges to the Senior College with (a) or without (b) AS degrees

It is yet to be seen whether graduation rates will also be higher for JD students compared to transfers from community colleges who were not part of the JD program. These results should be interpreted with caution due to the small number of students in each cohort.

GPA's can also be used to determine the success of the JD program and prediction of student retention. Figure 4 shows average semester GPA's (on a 4.0 scale) for each semester for which students in the JD program were retained at a senior college. First semester GPA's were on average at a relatively low 2.2, with even lower average GPA's for second semester of 2.0. In subsequent 2 semesters, student performance improved slightly, to 2.1. Data from figure 4 show that once students are retained beyond the 4th semester, their academic performance improves drastically to an average 2.8 in the 5th semester and 2.5 in the 6th semester. Performance of JD students at the senior college is strongly linked to their retention. Although 60-100% are retained in the first year, their performance is only slightly above the required minimum to continue at the senior college. Once students overcome the difficulty of adjusting to the senior college academic level, they perform well, and as a result may have a better chance of graduation with a Bachelor's degree.

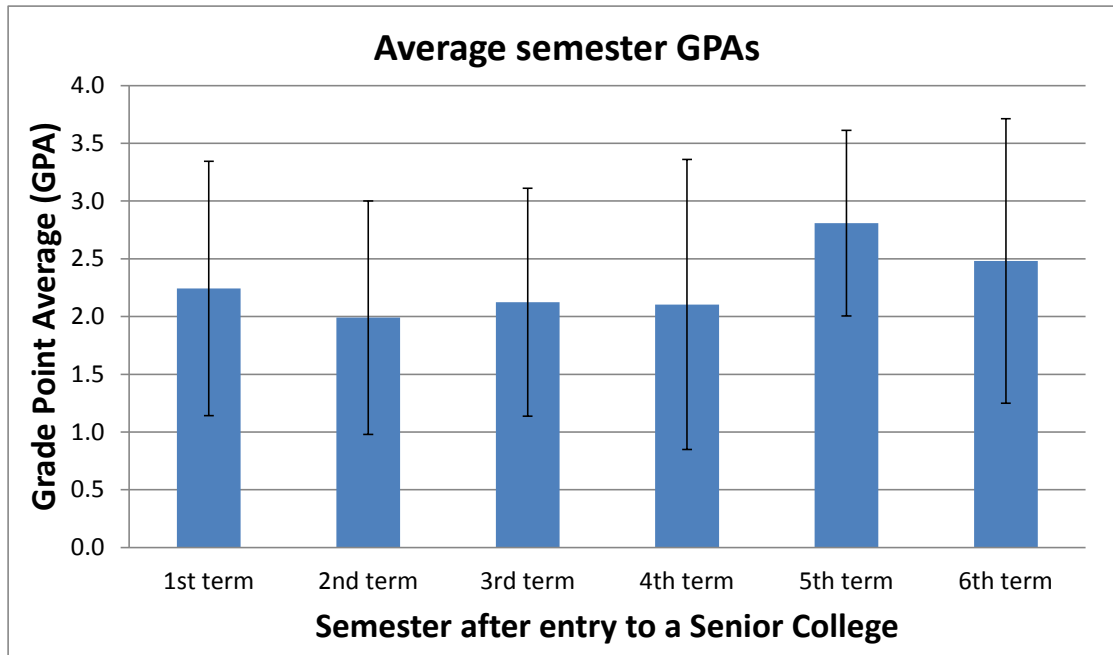


Figure 4. Average and standard deviations of semester GPAs at a Senior College.

Conclusions

Today many students are attending two-year schools as the first step to obtaining a bachelor's degree. Transferring from a two-year program to a four-year program can be perilous particularly if there is little communication between the institutions. The Joint/Dual (JD) programs between two junior colleges and one senior college within a major urban University system offer increased educational opportunities for underrepresented minorities in science and engineering fields who might otherwise be denied access to higher education. Advantages for students in the program include special orientation and advisement sessions, early registration, registration for courses on permit at a senior college while still attending the junior college, application fee waiver, straightforward transfer credit evaluation, and individual mentoring and support. Challenges include variations in curriculum of the first two years of engineering, differences in credit assignments, introduction of new courses into the JD curriculum, limited access to student's records, and communication between two- and four-year institutions.

Data from the JD program where students attend both the community college and the senior college at the same time for the first 2 years of their undergraduate study show that 44% of students graduated from the community college with an AS degree and a relatively high GPA average of 3.13. Those who did not graduate with an AS degree attained only an average GPA of 2.46. Poor academic performance at the junior college plays an important role in retention and graduation from the community college. Community college retention rates for student in the JD program were relatively high, especially for the first 2 years, indicating that students in the JD program have the necessary tools, support, and wiliness to remain an Engineering student. Graduation percentages, however, varied drastically depending on the cohort, and may be explained by major type. The four majors within the JD program have varying requirements at the community college level, with some majors, such as Civil Engineering requiring students to

take Civil Engineering courses at the senior college as part of their requirements for the AS degree. Inability to pass courses at the senior college may prevent students from graduating and being retained at the junior college.

Although 92% of those who graduated with an AS degree intended to matriculate at the senior college, only 53% actually took courses as a senior college student for at least one semester. Senior college retention rates were relatively high compared to retention rates for transfers from all other community colleges into the major urban University system, indicating that once JD students make the transition from the community college, they are more likely to be retained than those who did not receive the same support and advantages as students in the JD program. Performance of JD students at the senior college is strongly linked to their retention. Although over half are retained in the first year, their performance is only slightly above the required minimum to continue at the senior college. Once students overcome the difficulty of adjusting to the senior college academic level, their GPAs improve and, therefore, they may be more likely to graduate.

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