

ENSURING THE SUCCESS OF COLLEGE CREDIT PLUS USING TECHNOLOGY

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Abstract

College Credit Plus (CCP) program in Ohio has grown significantly in the last few years. In mathematics, students are able to complete pre-calculus courses while in high school. Beginning with remediation standards that lead to initial placement, classroom learning, transition to college, and success in college, technology has been used to provide a unique experience for CCP students. We will highlight how ALEKS, MyMathLab, and Notability platforms have been used to build the mathematics component of the CCP program and the follow-up mentoring program. Data on the success of the CCP program are highlighted throughout the article.

Introduction

It is predicted that by the year 2025, 64% of Ohioans aged 24-65 will have some form of a post-secondary degree that is relevant in their workplace (ODHE, 2017). With the goals of increasing high school graduation rates and growing the transition into post-secondary education, in 2014-2015, the Ohio Department of Higher Education (ODHE) introduced the newly redesigned College Credit Plus (CCP) program through Ohio Revised Code Chapter 3365. An avowed aim of the CCP program was to create meaningful and attainable pathways to achieve greater parity among ethnic minorities and the socio economically disadvantaged students.

Ohio's College Credit Plus program was established to help high school students earn college credit while enrolled in high school. When the redesigned program was introduced, Kent State University established their own goals and pathways, consistent with ODHE standards, to enable the offering of quality Kent State University "core" courses through the CCP program. Kent State University at Stark specifically played an instrumental role in crafting the 15 and 30 credit hour pathways and helped establish the fee structure for the Memorandum of Understanding (MOU). The MOU included clearly established floor tuition rates based on the poverty percentages of a district. The textbook costs were purposefully kept out of the main MOU with the intention of allowing each campus to determine how best to offer incentives to partnering schools. When CCP classes began in fall 2015, Kent State University at Stark became a dynamic partner in Stark County, working closely with the Stark County Educational Service Center (SCESC) to deliver a robust set of CCP courses through Kent State University. The school districts and the

SCESC have a long history of working together on grant-funded projects, and Kent State University at Stark and SCESC have a good history of collaborating on grant-funded endeavors. The section CCP Pathway One Grant of this paper details an example of one such partnership. The CCP program at Kent State University at Stark was expanded to include several new schools while staying true to the original purpose – the offering of rigorous academic coursework to high school students by promoting a variety of options.

The Kent State University at Stark CCP program has a geographically and socio-economically diverse blend of schools. The 2013 typology of Ohio school districts includes 7 rural, 7 small town, 4 suburban, and 3 urban districts. All of the urban schools, nearly all of the rural schools, and 2 of the 7 small town schools are classified as high poverty, and the 4 suburban schools are identified as low poverty. Several school districts are located within the Akron-Canton metropolitan area in Stark and Summit Counties. Others lie in the rural areas in the eastern, western, and southern areas of Stark County. Two school districts are located in the bordering Appalachian counties of Carrol and Tuscarawas, and one is located on the northern border of Amish Country in Wayne County. Combined, these school districts serve about 30,500 students in grades 7-12. Including all of these diverse school districts was challenging and was achieved through careful negotiations with each school district by understanding the needs and evaluating the allocation of necessary resources from both parties.

All CCP courses offered through Kent State University are selected from the Kent Core curriculum and meet the Ohio Transfer Module (OTM) standards. In particular, Kent State University at Stark CCP courses cover College Writing I and II, General Psychology, Introduction to Sociology, Seven Ideas that Shook the Universe (physics), General Chemistry I, Spanish courses, French courses, and three mathematics courses. The first mathematics course, Math 10041 – Introduction to Statistics, is one that is needed for majors that do not require college algebra. The other two pre-calculus mathematics courses are sequenced in successive semesters – Algebra for Calculus Plus in the first semester, followed by Trigonometry in the second semester.

In a report in 2017, ODHE released data for the second full year of the CCP program (ODHE Report, 2017), indicating that statewide student participation increased from 54,053 to 68,365. Stark County had the highest participation, leading with 8.1% (Looking at the Issues, 2018). Stark County's ranking at the top was largely due to the concerted effort by Kent State University at Stark to design a successful CCP program. Table 1 and Figure 1 illustrates the growth in CCP at Kent State University at Stark. Noteworthy increases occurred during fall 2015 to spring 2018 (Table 1).

CCP Pathway One Grant

In the redesign stage of the CCP program at Kent State University at Stark, we surveyed each school district in Stark County to assess their capacity to offer Kent State University courses in the 15 credit hour CCP pathway. We found uneven access to CCP courses among schools and also within schools by subject and, in general, a lack of CCP course offerings

in the core content areas. It was imperative that the success of the CCP program rested in having more credentialed teachers in each district who could fill the gaps in course offerings. Having identified this need earlier, ODHE, rolled out a CCP Credentialing Grant initiative in late 2015, allowing graduate programs around the state to offer 18 credit hour pathways for high school teachers to become eligible to teach CCP courses based on criteria approved by the Higher Learning Commission.

Table 1: CCP growth at Kent State Stark

YEAR	On Campus	Off Campus	Total
2011 Spring	107	50	157
2011 Fall	106	7	113
2012 Spring	91	43	134
2012 Fall	84	8	92
2013 Spring	99	86	185
2013 Fall	72	8	80
2014 Spring	41	116	157
2014 Fall	73	53	126
2015 Spring	56	143	199
2015 Fall	70	238	308
2016 Spring	60	356	416
2016 Fall	205	275	480
2017 Spring	210	433	646
Fall 2017	273	397	670
Spring 2018	269	537	798

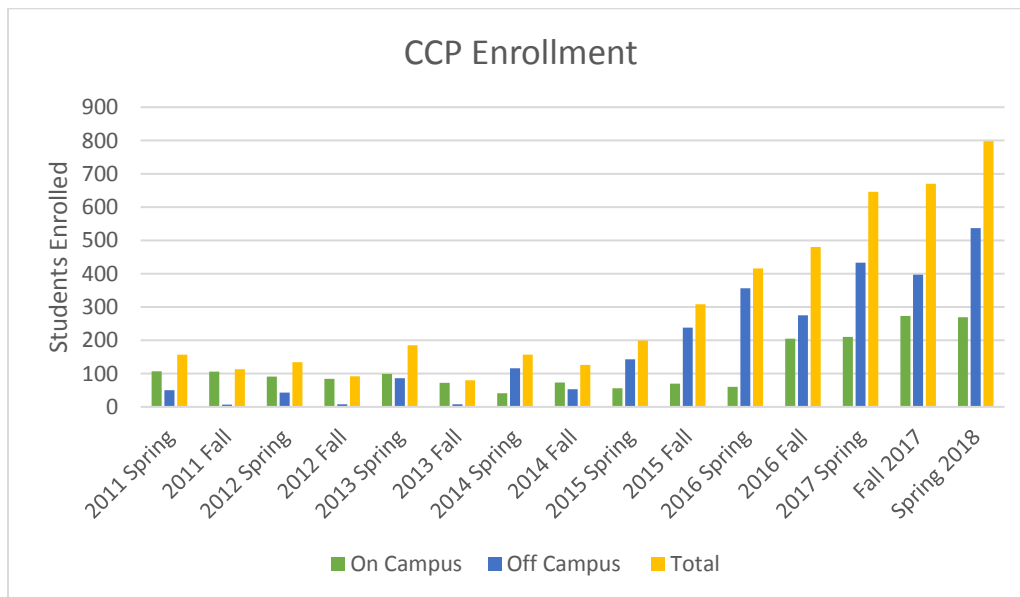


Figure 1: Graphical depiction of CCP growth at Kent State Stark

Kent State University received two College Credit Plus teacher credentialing grants. The Pathway One grant was through Kent State University at Stark (PI: Kasturiarachi, Co-PI: Pilati). This grant was a true collaboration between Kent State University at Stark and the Stark County Educational Service Center. The Pathway Two grant was awarded to the Mathematical Sciences department (PI: Soprunova). The College Credit Plus Pathway One teacher credentialing grant allowed qualified teachers in northeast Ohio to join Kent State University to complete graduate coursework. Teachers who already had a master's degree in education were eligible to complete 18 credit hours of graduate coursework in six different disciplines. The coursework was offered from spring 2016 through fall 2017. The grant covered tuition costs and textbooks. Pathway Two grant was similar and focused only on mathematics and supported professional development activities that would further strengthen credentialing in the specific discipline. The partnership between universities and high schools will no doubt benefit many students by giving them access to quality college courses, opening up avenues to a successful transition to college.

Pathway One grant credentialed 44 teachers in 6 disciplines. Twelve were in Mathematics, eight in English, seven in History, ten in Physics, two in Sociology, and five in Spanish. Additionally, Pathway Two grant credentialed another twenty two teachers in mathematics, bringing the total in mathematics to 34. Upon completion, all of these teachers were eligible to apply for adjunct faculty status at Kent State University. The teachers who were approved through the departments were provided with appropriate professional development through several orientation programs. The CCP grant program was successful in building capacity in the high schools and allowed Kent State University to expand its outreach to more feeder schools in northeast Ohio.

Testing

In 2012, The Presidents of Ohio's Colleges and Universities set the remediation free standards across the state. These standards were revised in 2016-2017 to include additional assessment tools, such as ALEKS¹. Kent State University had already adopted ALEKS as a placement tool in Mathematics and Chemistry and therefore the transition was seamless. ALEKS placement test can be accessed by all prospective students from their high school or home. After testing, if they are happy with the initial score, the placement to a mathematics course is done using the template in Table 2. If a student wants to retake ALEKS, they must study using a 5 week online ALEKS module and retest in person on-campus, to seek a placement into a higher mathematics course. One key feature of ALEKS is its ability to identify threads and gaps in student understanding and customize a suitable pathway for each student to fill deficiencies in their knowledge. The span of ALEKS allows us to place a student into mathematics courses that require pre-calculus as well as courses that do not require pre-calculus. The latter courses were developed to conform to pathways recommended by Complete College America. Two such courses at Kent State University are Introduction to Statistics (StatWay) and Quantitative Reasoning (QuantWay).

¹ Assessment and LEarning in Knowledge Spaces (ALEKS) is a Web-based, artificially intelligent assessment and learning system.

Table 2: ALEKS placement template for mathematics courses
(Source: Academic Success Center at Kent State Stark)

2018 Placement Assessment for Math

FOR MAJORS NEEDING ALGEBRA

ALEKS PLACEMENT SCORE	21 or Lower ACT Math 520 or Lower SAT Math	22 or Higher ACT Math 530 or Higher SAT Math
0%-9%	Math 00020	Math 10771 Basic Math Concepts I Plus
10%-24%	Math 00021	Math 10772 Modeling Algebra Plus
25%-34%	Math 00022	Math 10773 Algebra for Calculus Stretch1
	ANY ACT OR SAT SCORE	
35%-44%		Math 10771 Basic Math Concepts I Plus Math 10772 Modeling Algebra Plus Math 10773 Algebra for Calculus Stretch1
45%-54%		Math 10775 Algebra for Calculus Plus
55%-66%		Math 11009, 14001 Math 11010
67%-77%		Math 11012, 11022, 12001, 12011
78% or higher		Math 12002, 12021

FOR MAJORS NOT NEEDING ALGEBRA

ALEKS PLACEMENT SCORE	21 or Lower ACT Math 520 or Lower SAT Math	22 or Higher ACT Math 530 or Higher SAT Math
0%-9%	Math 00020	
10%-24%	Math 00021	NO ALEKS PLACEMENT NEEDED. These students place directly into Math 10041, 10051, or 11008.**
25%-34%	Math 00022	
35%-44%	Math 10041, 10051, 11008	

** Those students desiring to take a course other than MATH 10041, MATH 10051, or MATH 11008 must take the ALEKS assessment.

Courses

The CCP courses that are part of the 15 and 30 credit hour pathways are exclusively selected from the “core” courses and satisfy the Ohio Transfer Module. About 60% of the CCP courses offered through Kent State University at Stark are at high school sites (Table 1). The learning outcomes and assessments are standardized for all courses. The

coordinator of each department is responsible for peer reviewing the CCP instructors and for assisting with pre academic year professional development workshops. Due to course delivery in multiple remote locations, ensuring that learning outcomes are followed and meaningful academic success initiatives are implemented for students, becomes challenging without technology.

There are three mathematics courses offered through the CCP program: Algebra for Calculus Plus (4 credits), Trigonometry (3 credits), and Introduction to Statistics (3 credits). The first two courses together are considered the pre-calculus block. All three mathematics courses have an online homework system built through MyMathLab. Students have access to additional practice problems as well as short concept videos through MyMathLab. The MyMathLab system is managed by the CCP instructor and the course coordinators. By keeping tab on performance statistics, we are able to compare the performance of CCP students and other freshman in the Kent system who take the same course. In the next year the Mathematical Sciences Department hopes to implement a common final in the pre-calculus sequence. Having MyMathLab in place is beneficial as the CCP program evolves to integrate more aspects of the core courses, which will ensure success in subsequent mathematics courses.

Academic Success

Kent State University is committed to providing all students the tools needed to succeed in their coursework. For all mathematics courses, in-person tutoring and online tutoring are available to students at Kent State University at Stark. Students may request tutoring in any special area of mathematics and a qualified tutor will be identified for them. Faculty tutors are also available for students who need help with effective study strategies. Peer tutors assist students with homework assignments, clarification of lecture and classroom materials, and review for exams. In addition, students have access to free online tutoring through the Ohio Collaborative e-Tutoring Network that covers Biology, Chemistry, Mathematics, Statistics, and College Writing.

The CCP students who come to campus for their courses have access to the same tutoring resources as other students. The CCP students who take college courses in the high schools have limited access to on-campus tutoring. In order to address this deficiency, the Academic Success Center of Kent State University at Stark has worked with several high schools to send student tutors to high schools to tutor mathematics. Although limited in scope, this effort has resulted in positive outcomes. In the upcoming academic year, we will make judicious use of technology to reach out to CCP students taking classes in high schools and provide on-demand tutoring. We are piloting a project with Notability. Using the Notability platform, we will assist students by sharing hints and solutions to mathematical questions through the exchange of PDF files. These files could be added to the Blackboard Learn sites for each course. This would require collaboration with high school CCP instructors, further strengthening the partnership between college and high school faculty. A sample of a Notability PDF file is provided in Figure 2.

Prove the following trigonometric identity.

$$\frac{2 \tan(x)}{1 + \tan^2(x)} \equiv \sin(2x)$$

Start with LHS = $\frac{2 \frac{\sin x}{\cos x}}{\sec^2(x)} = \frac{2 \frac{\sin x}{\cos x}}{\frac{1}{\cos^2(x)}}$

$$= \frac{2 \sin x}{\cos x} \cdot \frac{\cos^2(x)}{1} = 2 \sin x \cos x$$

$$= \sin(2x)$$

$$= \text{RHS Q.E.D.} \quad \color{red}{\downarrow}$$

Figure 2: Sample Notability exchange file

Outcomes

Replicating the college experience in high schools is difficult to achieve. All CCP courses must have the same learning outcomes as the college course and we need to compare the assessment outcomes to understand if there are deviations in student performance based on the delivery location. While some variables cannot be controlled, Kent State University at Stark, has worked with several school districts to brand our CCP courses in a manner that replicates the college experience. We have done so by helping with the design of learning environments, introduction of software in mathematics, and offering additional tutoring help.

Students receiving co-requisite remediation succeed at the same level as students without remediation needs (ODHE, fall 2017). Therefore, we decided to offer Algebra for Calculus Plus (4 credits), instead of Algebra for Calculus (3 credits) in the first semester. Students who pass this course were allowed to enroll in Trigonometry (3 credits) in the second semester. Collectively, these two courses form the core for pre-calculus. Students whose intended major does not require pre-calculus were allowed to enroll in Introduction to Statistics (3 credits) to fulfill the Ohio transfer module mathematics requirement. Figures 3-5, depict the grades earned by CCP students from fall 2016-spring 2018 in the three mathematics courses covered by Kent State University at Stark. Passing grades (A, B, or C) were earned at a very high percentage, even exceeding the state average of 91.2% (ODHE, 2017).

In a future project, we will look at students who matriculate to Kent State University and track their performance in subsequent mathematics courses. We will also observe their success in college more broadly to include the performance in their declared major. Strong performance in mathematics has shown to be an indicator of future success in college (Kasturiarachi, 2004). Therefore, tracking the performance of CCP students in college can help us to discover focal points in the CCP program. As part of this new initiative, we will look at three components. The first is faculty and peer mentoring targeting matriculated CCP students. Academic advising is considered a fundamental component of the college

experience. At Kent State University this includes advising on courses, experiential learning requirement, GPS roadmaps for majors and minors as well as planning for study abroad, internships, and other high-impact educational practices. The second component is to enhance the opportunity for undergraduate research through the Undergraduate Research Assistant (URA) program at Kent State University at Stark. Undergraduate research is a high-impact educational practice (Kuh, 2008) that boosts student retention by promoting active learning, especially in the STEM fields. Finally, the third component is to create a Learning Community for CCP students. Such a learning community will add value to the educational experiences by engaging and connecting students with faculty, peers, and resources (Zhao and Kuh 2004). Details of the three component project will be reported in the near future.

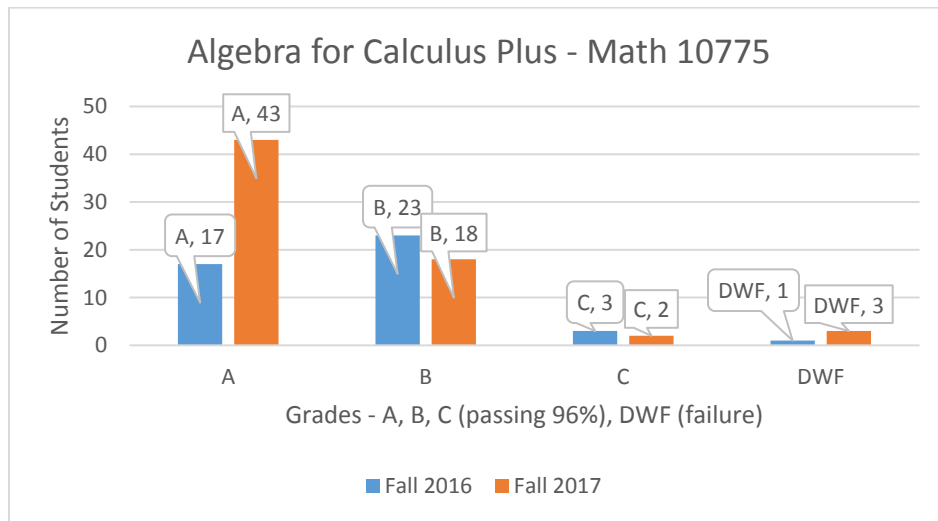


Figure 3: Grade distribution in Algebra for Calculus

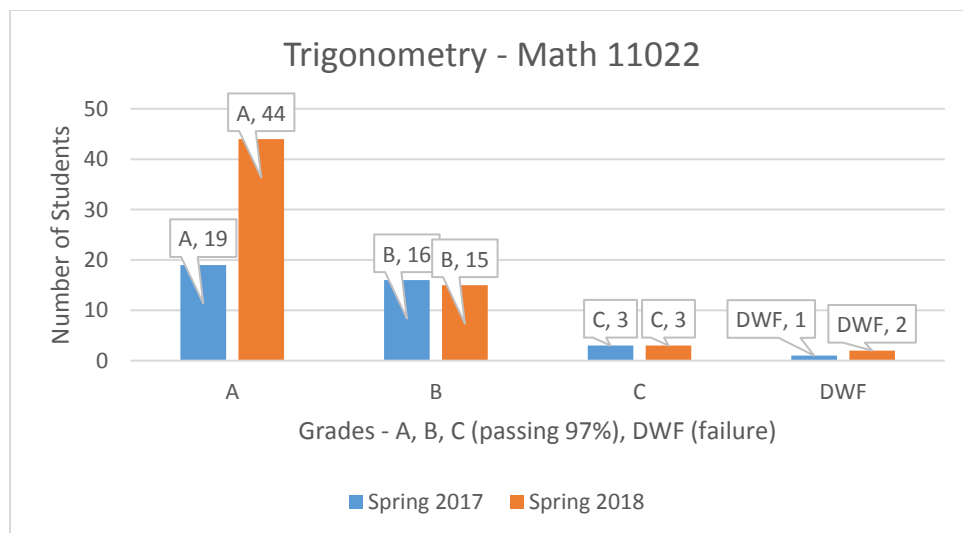


Figure 4: Grade distribution in Trigonometry

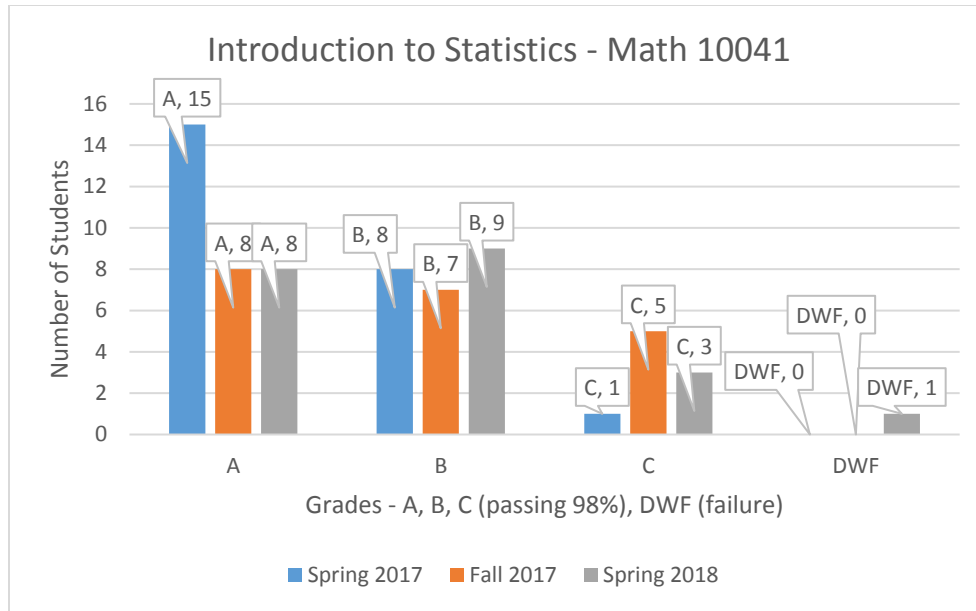


Figure 5: Grade distribution in Introduction to Statistics

Conclusions

The growth in the College Credit Plus program in Ohio has successfully contributed to bridging the gap that exists between high schools and college. In CCP mathematics, the success can be attributed to technology that can deliver components of CCP efficiently. Initial placement (using ALEKS), classroom learning (using MyMathLab), and success in college courses (using Notability) are a few examples where technology has made positive changes. The CCP program has also allowed Kent State University to create a strong pipeline from high school to college. For example, Kent State University at Stark has seen an increase in the matriculation percentages to the campus through the CCP program from 10% to 14% in a period of two years. Future goals of the program will include the creation of outreach programs in middle schools that prepare students for CCP, increase in scholarship funds for CCP students who matriculate to universities, and special initiatives that are designed to attract students to STEM fields.

References

- Kasturiarachi, A. Bathi. (2004). *Counting on Cooperative Learning to Uncover the Richness in Undergraduate Mathematics*. PRIMUS, Volume XIV, Number 1, March 2004, 55-78.
- Kuh, G. D. (2008). *High-impact educational practices: What they are, who has access to them, and why they matter*. Washington, DC: Association of American Colleges and Universities.

Looking at the Issues. (2018). Stark County Educational Partnerships, Inc.
http://www.edpartner.org/links/issues_01-12-18.html

ODHE. (Fall 2017). *Student Success: OACAC Articulations*. Retrieved from
<https://www.ohiohighered.org/ccp/resources>

ODHE Report. (2017). Retrieved from
https://www.ohiohighered.org/sites/ohiohighered.org/files/uploads/CCP/CCP-REPORT-2016-2017_FINAL_010418.pdf

Zhao, Chun-Mei; Kuh, George D. (2004). *Adding Value: Learning Communities and Student Engagement*. *Research in Higher Education*, v.45 n2 p115-138, Mar 2004.