National STEM Consortium Model Report

An Analysis of the NSC Model Components

Report to:
Anne Arundel Community College
National STEM Consortium
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TABLE OF CONTENTS

INTRODUCTION

The National STEM Consortium (NSC), nearing the end of its funding period with the U.S. Department of Labor (USDOL), is focused on sustainability and scaling of their programs and the various components that comprise them. In order to better understand how the NSC educational model functions and how it fits within the current landscape of community college education innovation, the NSC tasked Hezel Associates researchers with conducting an in-depth examination of the model elements.

NSC developed 5 technical tracks across 10 community colleges. Participants in the program were intended to be Trade Adjustment Assistance (TAA)-eligible, the long-term unemployed, and underemployed individuals. While the curriculum content was focused on providing specialized skills for rapid employment, the strategies that the NSC model employed were specifically aimed at improving retention and time to completion rates among their participants. The model consisted of the following elements:

- **Block scheduling:** a scheduling format where students have fewer and longer classes each day compared to traditional shorter classes a few times per week
- **Cohort enrollment:** consists of groups of students entering a technical track together, attending the same courses, working through curriculum at the same time and pace, and completing together
- **Compressed classroom time:** defined as the same number of contact hours as a traditional program, but delivered over a shorter number of weeks.
- **Employer linkages:** a high level of involvement of local and regional employers at the program level in curriculum development and review, advisement on or providing equipment, and career placement
- **Hybrid delivery:** a mix of online and face-to-face instruction, at the program level
- **Navigator:** an institutional staff member who serves as a single point of contact from recruitment through job placement, specifically for a technical track
- **STEM Bridge:** an accelerated program, composed of brief modules with a focus on STEM careers, intended for remediation in math, reading and writing, and soft skills

Hezel Associates conducted research to help answer the following question: *What is the promise of components of the NSC model on community college education?* To examine this, focus was placed on the implementation and effectiveness, in terms of student retention and completion, of each component of the NSC model, and further investigation into the relationships between them. This is in contrast to the USDOL-mandated external evaluation of the NSC project, which examined outcomes for delivery of the entire model across all consortium partner sites. Components were examined by re-evaluating data collected throughout the grant period, conducting a new round of interviews, and reviewing existing literature on the subjects. Because the elements were not necessarily implemented consistently across the 10 colleges and technical tracks, actual levels of implementation were determined, along with stakeholdersô perceptions of effectiveness of the elements. This allowed researchers to develop an initial depiction of which elements were most effective, in what ways, and for whom; and to identify elements that are best used together. Information from the literature review gave a broader perspective on how these elements are used outside of NSC, whether or not NSCôs implementation methods or results

were unique or in line with other similar efforts, and how the NSC model fits into the current body of research.

The intention of the following report is to examine the NSC model in the context of the larger knowledge base regarding its elements. The hope is that these findings will provide a basis for future research and development of promising strategies for community colleges more broadly, even beyond STEM workforce development programs.

METHODS

To gather information on the NSC model elements, both as implemented and in the larger education arena, a variation of the sequential exploratory mixed method strategy was employed (Creswell, 2009). This entailed using the data collected previously (in grant years 1-4) via the Program Faculty and Staff Interviews, Employer/Industry Partner Interviews, Student Interviews, and Student Questionnaires, to inform the development of an interview protocol focused on implementation and effectiveness of the model elements (referred to as Project Staff Component Interviews). Because the component research was not added until the final year of the project, previously collected data were re-reviewed with a focus on the model elements to determine further data needs.

Instrumentation, Data Collection, and Analysis

Review of Previously Collected Data

Raw qualitative data from the Program Faculty and Staff Interviews (Years 1-4), Employer/Industry Partner Interviews (Years 2-4), and Student Interviews (Year 3) were reexamined to extract data specifically regarding each model elementôs implementation and perceptions of its effectiveness. A preordinate scheme was utilized to elaborate themes among the pooled data. Qualitative data collected from Student Questionnaires (Years 3-4) was also revisited, and data related to model elements (in the form of frequencies) were examined to support or disconfirm emerging interview findings. These instruments can be found in previous NSC evaluation reports.

Project Staff Component Interviews

An interview protocol was designed to collect data regarding NSC collegesô implementation of each element, as well as their perceptions of each elementsôeffectiveness. Based on the review of previously collected data, areas where information was lacking or where more in-depth data were warranted were identified. This allowed researchers to focus on those areas when developing the interview questions. Eleven questions were created, centered on each element, their relationships with each other, and the impact they may have on various student groups. The Project Staff Component Interview Protocol is included in the appendix.

Twelve project staff members were selected for interview participation, based on their knowledge of the NSC model within their college and/or technical track. Participants were recruited via email and interviews were conducted over the telephone. Once all data were collected, a preordinate scheme was utilized to identify themes among the responses.

Literature Review

To appraise current collective understandings and use of versions of the NSC model elements in post-secondary education, a review of relevant literature was conducted. Definitions of each model element were generated in collaboration with the NSC management team. These were used to specify search terms used to retrieve literature from various sources. Documents, including journal articles and organizational reports, were reviewed. Information pertinent to the guiding research question was summarized and used in support of, or opposition to, findings from the NSC data.

FINDINGS

The following section provides information on the implementation of each model element within the NSC model, and the effectiveness of each, considering both NSC students and existing literature on similar programs. The potential of effectiveness as well as challenges of implementation, are summarized in Table 1, following the individual summaries. Finally, a discussion is provided on the relationships between elements, also based on NSC data and previous research in the field.

Block scheduling

Most NSC institutions implemented block scheduling, where courses were structured to meet less frequently, but for longer periods of time than traditional college courses. The structure varied among colleges; however, most met 4 days per week, between 4 and 8 hours per day. Hours spent in the classroom per week ranged from 16 to 32. Program staff agreed that this format helped students be successful in their programs, as the longer meeting time pushed them to focus more on their work and allowed them to have plenty of in-class time to complete assignments and lab work. This format can also streamline the registration process, easing the burden on students (Spaid & Duff, 2009). Staff attributed an increased retention rate to these effects, which is a measured outcome of the NSC project, estimated at 83%. One college implemented an 8-hour per day schedule, resembling an actual workday, to help prepare students for a workplace schedule.

Specific research on block scheduling in higher education is lacking, as this format is more common in a secondary education setting. However, in a post-secondary setting, block scheduling is often discussed as an essential component of a learning community model (i.e., a cohort model) (Buch & Spaulding, 2008; Hotchkiss, Moore, & Pitts, 2006; Raferty, 2005). This scheduling format allows cohort students to be together for longer periods of time, creating an environment where more experiential learning and collaboration can occur.

Cohort enrollment

All NSC colleges implemented cohort enrollment, grouping students together in their coursework as they progressed through the program. This model encourages more active group work, as opposed to independent work, and facilitates relationship-building between students as they work more together than a typical community college structure, where each class is a new group of students (Grubb, 1999). The value of a cohort model, often called a ñlearning communityò is supported by current research; however, there must be a ñcommunal componentò in addition to the structure of the cohort, which creates a climate of learning and academic support (Wathington, Pretlow, and Mitchell, 2010). Wathington et al. (2010) found three commonalities between successful cohort model sites they studied: (a) a positive classroom climate, (b) academic support networks, and (c) student-faculty relationships. This translates into what has occurred at the NSC colleges, as support systems were in place through tutoring and the navigators, and the relationships between students and instructors were noted as an element of the cohort model.

Additional essential components of cohorts, as reported from an examination of Mount Olive College in North Carolina by Spaid and Duff (2009), are: (a) allowing for interdependence to facilitate development a group dynamic, (b) promoting mutual respect, (c) supporting the

consideration and reflection of different opinions, (d) creating a space where students can safely take risks, and (e) using self-reflection activities. Additionally, Buch and Spaulding (2008) explained that embedding students who are not part of the cohort into some courses keeps a cohort from becoming ñinsulatedò from the rest of the college.

Within NSC colleges, this model typically functioned well; however, one school originally allowed several program entry points in one academic year for cohorts, which caused problems with coordination of time in the labs. They reduced the number of entry points, and this issue was resolved. Several student benefits were identified by program staff, in particular, peer support and camaraderie building. It was noted that the support students can provide to each other resembles relationships created in the workplace, as they spend a substantial amount of time together and work through the same tasks. NSC students surveyed during the grant period indicated satisfaction with the model, and students who were interviewed recognized it as a strength of the program, noting that students were ñable to help each other.ò

Faculty members benefit from cohort enrollment as well because they can track studentsô progress and success more efficiently, as mentioned by NSC staff. It also pushes instructors to explore different teaching methodologies that are more conducive to group activity, including problem-based learning, experiential learning, and collaborative learning (Hesse and Mason, 2005). In the cohort model, relationships not only develop between students, but between instructors and students as well. As one NSC student interviewee noted, ñThe instructors have a personal interest in people succeeding.ò Last, this model has benefits for employment as well. Employers involved with NSC appreciate that a group of students complete the program at the same time, as it streamlines their recruiting and hiring process to specific times of year.

NSC program staff cautioned that while cohorts foster student success, a cohort that is too small does not function well. In these instances, students were unhappy, likely because any personality conflicts were magnified within a small group. Those with 15-25 students reported success; however, it is unknown how many constitutes ñtoo few.ò Research on the ideal size of a cohort was not located in the literature; however, Spaid and Duff (2009) defined a cohort as a group of 10 to 30 students.

Compressed classroom time

NSC technical tracks ranged from 6 months to a full calendar year, with students earning 26-34 credits, depending on each trackôs requirements. Most were structured as two semesters, some with additional summer courses or an internship. The Composites programs were 6 months in duration, in which students earned a short-term certificate at the end of each semester.

Overall, program staff and students were satisfied with the compressed schedule. In particular, program staff noted that the 6-month schedule of Composites worked well for employers, who were appreciative to have completers with basic technical training ready to work so quickly. However, both program staff and students expressed concern with the compressed schedule of the Cyber Technology program. Many stated that it was too condensed for the amount of material to be covered. Because much of the curriculum is geared toward industry certifications and exams, the amount of material to be covered is fixed. Some students had still not taken the

certification exams well after they completed the program, and their employment options were limited until they passed the exams.

Research has shown that student performance varies when comparing those in a condensed format to those in a traditional setting. Decreased student performance has been documented in a randomized control study, where students in a traditional format were reported to have scored better on mid-term exams than those in a condensed format of the same course (Joyce, Crockett, Jaeger, Altindag, & O'Connell, 2015). Other studies have found that those on a condensed schedule actually performed better on exams and were more successful in completing courses than their counterparts (Logan & Geltner, 2001; van Scyoc & Gleason, 1993).

In terms of stakeholder perceptions of the compressed course approach, there have been both negative and positive attitudes reported in the literature. Studies have found that students participating in compressed developmental course formats (a) had higher levels of motivation than their counterparts in traditionally formatted developmental courses, (b) appreciated that this model allowed more time for student-faculty interaction, and (c) preferred meeting more frequently during the week for fewer weeks in total (Carley, 2002; Daniel, 2000). Though experiences were typically positive, students still felt that they had less time to complete assignments and often perceived greater stress under these course conditions (Daniel, 2000; Rosen, Howel, & Johnson, 1982). Studies noted that faculty attributed a decreased likelihood to withdraw from a course to compressed courses, due to greater instructional effectiveness and experiential activities (Beachler, 2003; Daniel, 2000; Rosen et al., 1982).

Employer linkages

All NSC colleges were active in employer engagement, whether building upon existing relationships or developing new contacts. Many employer partners served on an Advisory Board specific to their technical track, and advised on various aspects, including technical curriculum, soft skill needs, marketing and recruiting, labor market trends, and credentialing. Some donated equipment for training, while others served as guest lecturers; taught courses; assisted with career preparation, such as mock interviewing; offered tours of their facility for participants; and provided mentorship to students. Others focused on hiring, participating in job fairs, developing internships for NSC students, and actively seeking out and hiring completers. Many were able to help facilitate additional employer or industry association connections for the NSC programs as well.

These activities within the NSC-employer partnerships have been identified as best practices in the literature. Current research suggests that employer linkages must go beyond advisory committee involvement and include activities like curriculum design, career mentoring, internships, and use of collaborative postemployment assessments, as these engagements allow both entities to leverage one anotherôs resources and progress toward reaching desired goals (Atwater, 2014).

All program staff touted the success of their employer engagement, particularly as it relates to student success. NSC students were frequently exposed to local employers, through frequent technical track-specific job fairs, classroom or lab visits, or tours of local facilities. According to students interviewed in grant Year 3, this allowed them to ñrub elbowsò with industry and

establish relationships that helped them find employment at the end of the program. The availability of internships for NSC students is also directly tied to subsequent employment, as many employers use them as a ñtest runò which can often result in a permanent position.

Adams (2015) asserts that for employer linkages with higher education programs to be effective, communications must be frequent and regular, interactions should be abundant, and guidance needs to be provided consistently to stay well-informed about workforce trends and changes. This was identified as a challenge for many NSC staff, as the time investment needed to establish and maintain these relationships can be onerous. Diligence is needed, as employers are busy with their own jobs, and therefore scheduling time to meet or speak with them can be difficult. Determining how employers can best contribute to the program goals was also sometimes time consuming. Other challenges were identified in the literature; however, these were not found to be readily apparent in the NSC colleges. That said, NSC colleges should be mindful of these in order to maintain partnerships with industry. These include a pronounced cultural divide, as employers and educators operate in different, often clashing cultures (Adams, 2015). Businesses have also shown reluctance to share information, like job placement projections, as they can be a threat to the companiesô proprietary data so potentially problematic in competitive markets (Adams, 2015). Institutions of education can also face challenges in restructuring programs with business involvement since they must typically meet various requirements on federal, state, and local levels (Adams, 2015).

Atwater (2014, p. 6) holds that ñstrategic partnerships between colleges, local employers, economic development agencies, community-based organizations, and workforce boards are producing new and more comprehensive workforce models that simultaneously address student and employer needs.ò However, it is not enough for colleges and workforce entities to engage in partnerships only during initial stages of program endeavors or to do so in traditional ways. Sustained engagement of industry partners is critical for both institutions of higher education and the workforce industry (Atwater, 2014). This may prove to be a challenge for NSC institutions as the grant funds end and staff may no longer be available to maintain employer relationships at the level necessary to sustain the momentum built up during the grant.

Hybrid delivery

A mix of in-person instruction and online coursework comprises hybrid curricula. NSC technical tracks were designed in this way, combing aspects of online and face-to-face instruction. A few courses of the technical tracks were administered completely online and tended to focus on theoretical aspects of the technical content or professional skills (e.g., STEM Bridge). Other courses were composed of a mix of face-to-face instruction and online components, with practice labs, theoretical aspects, sticking points, and quizzes or exams online, and hands-on instruction face-to-face. The Mechatronics curriculum incorporated Tooling U into coursework, which is a suite of online manufacturing training tools that an institution pays a fee to use with their students.

While the NSC curricula were essentially hybrid, the bulk of content for each track was in-person, as program staff believe is appropriate for highly technical content. Hands-on lab work is crucial for the training needed to complete the coursework, therefore, online content was limited. In addition, some tracks, particularly Environmental Technology, consisted of embedded

industry certifications which require hands-on training (e.g., OSHA), so online work was not an option for most aspects of this technical track.

The general consensus among project staff and faculty was that online coursework was effective, allowing students to work at their own pace and serving to streamline grading and paperwork that for instructors. However, program staff cautioned that instructors must have a basic understanding of the technology to effectively lead an online course. In contrast, most students interviewed and surveyed throughout the course of the grant expressed a preference for in-person instruction, citing difficulties reading on a screen (likely a particular concern for older adult learners) and lack of communication with instructors as reasons they disliked online coursework.

Rausch and Crawford (2012) posit best practices for instructors teaching in a hybrid curricula environment, which include holding an in-person meeting at the beginning of an online course to help establish student trust and creating a sense of community among the students during the online coursework. These strategies could alleviate some of the reservations of NSC students regarding online learning.

Navigator

Nine of the 10 NSC colleges had a dedicated grant navigator on staff. Two colleges combined the navigator and program coordinator role. Some were full-time, while others were part-time. In most colleges, the navigatorôs role was to work with NSC students one-on-one to guide them through their program. This included actively recruiting students (outreach and marketing), assisting with NSC student admissions (i.e., financial aid, registration), advising on course selection, providing referrals to external services when needed, and connecting with employers to facilitate job placement. The colleges in Washington State took a slightly different approach to the position, where an individual served as an advisor at a group-level, coming into classes or working with small groups specific to the program.

Best practices uncovered in the literature regarding advising for community college students emphasize that it is the ñprocesses, not programsò that should be the focus (Karp, 2011). This means that colleges must ensure students are able to engage in the advising structure in order to facilitate their success, which goes beyond developing and delivering program curriculum. Additionally, advising should be as streamlined and personal as possible, as large-scale outreach misses many students. This type of focused advising, like the NSC navigator model, can disseminate information more efficiently and accurately than large, untargeted outreach (Karp, 2011). This model relies on a low student-advisor ratio; therefore, resources may be a limiting factor (Rodgers, Blunt, & Trible, 2014).

Navigators employed an intrusive advising method, where they proactively reached out to students to make sure they were receiving the guidance needed, instead of waiting for students to request assistance. This method has been shown in the literature to be successful, because it operates under the assumption that all students need some form of assistance, and by reaching out to all students, those who do not know they need support or are unsure will still receive the benefits of advising (Karp, 2011). In a quasi-experimental study performed by Rodgers et al. (2014), an intrusive advising model was used with students in STEM programs in a community college. This resulted in higher retention rates when comparing those students to students who

enrolled in the same programs in the years before the intrusive advising was in place (from 32% in the comparison group to 53% in the treatment group), as well as improved academic performance in math courses.

Several other aspects of advising models similar to the navigator help to generate student success. Students who understand the utility of their academic program and see how it relates to subsequent employment or further education are more likely to stay in their program (Karp, 2011). Having the one-on-one relationship with a navigator allows the student to better understand the purpose of the program content and how it will fulfill employment needs, particularly because the navigator is connected with employers. A navigator can also help students become familiar with the culture of the institution and be better able to identify and utilize services within the college. This is particularly true for non-traditional students, like many of those in the NSC programs, who may be new to college life (Karp, 2011). Not only are they new to college, program staff noted that many NSC students have external challenges that have the potential to hinder their academic success, such as child care issues, health problems, and housing deficiencies. The navigator, by establishing relationships with students, is able to uncover these potential issues and recommend or facilitate access to services that will help. Prior research has demonstrated that students who are supported by an advisor regarding such issues are more likely persist in their program, as well as show gains in academic performance (i.e., grade improvement) (Karp, 2011; Scrivener & Au, 2007). Karp (2011) noted that this is because students who sense that their institution has a stake in their success and wants them to perform well are more likely to stay enrolled.

All NSC colleges with navigators acknowledged this componentôs importance in helping students stay in and complete their programs. Those colleges who did not include a navigator position noted that their students would have benefitted from one. Some navigators were not hired until mid-grant, and program coordinators expressed disappointment that the cohorts beginning before then were not able to take advantage of the extra support. (Stebleton & Schmidt, 2010) caution that the first semester for students enrolled in associateôs degree programs is critical for intense advising, and that those who do not receive it are more likely to withdraw from the institution. Students have also been shown to be more ñreceptiveò to advisement at that time than later in their programs (Rodgers, et al., 2014). Because the NSC programs are condensed, advisement at the start of the certificate programs is clearly crucial; therefore, program staff concerns for those students who did not receive support from the start are well-founded.

While one-on-one advising appears to benefit all students, it has been shown to benefit some groups more than others. Students who are underprepared and/or disadvantaged socially, economically, and academically tend to benefit more from intrusive advising (Karp, OôGara, & Hughes, 2008). Often they are not familiar with the institutional infrastructure to seek assistance or are resistant to looking for support; therefore, direct and individualized outreach is key to their success. The research supports that the navigator does indeed help NSC students, as these characteristics are often apparent, including needs for math and English development, economic pressure (unemployment or underemployment), and health needs.

While navigators foster student success, barriers to this type of advising exist. The most common is financial, as colleges often do not have the resources to employ and sustain staff to provide individualized counseling. Therefore, the less intrusive and less frequent model of advising is more typical. If a navigator-like model can be implemented, it must be done in such a way that the advisor is trained appropriately to give the student accurate information clearly and in culturally-sensitive ways (Karp, 2011). If this does not occur, the advising could hurt, rather than help, a student.

STEM Bridge

Program staff explained that most students coming into the NSC programs needed extra assistance to develop and/or refresh basic skills before successfully completing their curriculum. This is not only an NSC issue, as 5 out of every 10 students entering an associateôs degree program need some sort of remedial coursework, and only one of those students needing remediation will earn their degree within 3 years (Complete College America Report, 2012). In a condensed 1-year certificate program aimed at individuals who have been unemployed long-term and/or have not attended college for several years, this need is arguably magnified.

Development of STEM Bridge was intended to address this issue. The STEM Bridge curriculum is essentially contextualized learning of remedial content focused on relating learning modules to NSC technical track subjects. STEM Bridge consisted of two portions: *STEM Readiness*, which was intended as a refresher in math, communication, and professionalism and *STEM Foundations*, a set of modules to ensure that students have adequate skills in writing, reading comprehension, and communication in order to complete their program. *STEM Foundations* was designed as a remedial-type course, while *STEM Readiness* was meant to allow students to review what they may have learned in the past. In both, real world scenarios specific to the technical tracks were built in, developed using input from employer partners, covering topics including email communications, customer service skills, and troubleshooting.

All technical tracks used STEM Bridge; however, implementation varied among the colleges, as most allowed students to complete modules throughout their program and others required that they completed it before their program began. Some colleges required students to complete modules as part of their program, while others allowed students to only take them if the students felt they needed the additional help. The Composites technical team staff noted that STEM Bridge allowed them to focus less on math content in the actual program and make room for other topics within the curriculum.

Most program staff found STEM Bridge to be effective in furthering their studentsô success. In fact, one school was able to compare students who took STEM Bridge to those who did not within the technical track and noticed a correlation to better academic performance for those who participated in STEM Bridge. In particular, those institutions that allowed students to take STEM Bridge throughout their program, as opposed to before it began, particularly noted student success. Literature supports the effectiveness of contextualized learning for remediation, as similar programs have been connected to student achievement. One common example is the Integrated Basic Education and Skills Training (IBEST) system utilized in Washington State, in which math and English remediation is contextualized and woven into career skills training. A study comparing IBEST students to non-IBEST students in community colleges found that

IBEST students earned 32% more credits, were 22% more likely to persist into their second academic year, and were 73% more likely to earn a credential or degree (Jenkins, Zeidenberg, and Kienzl, 2009).

That said, many NSC students surveyed and interviewed over the course of the grant believed the STEM Bridge content was too easy. This was mostly apparent for students in programs where STEM Bridge was required, which is expected since students who may not have needed the extra help were asked to complete the modules anyway. Also, students in the Cyber Technology program most often indicated that the STEM Bridge content was not challenging. More of these students entered their certificate program with a bachelorôs degree or higher than other NSC programs; therefore, many of these students likely did not need the added support.

While the effectiveness of contextualized remedial learning is apparent (as long as it is targeted at students who need the support), there are several challenges to implementing a model like this. The most obvious is financial, as creating specific remedial content to fit with a program requires substantial staff time and resources that may not readily be available for non-credit courses (Hamilton, 2013). It is not yet well understood how effective these models are and for whom. As Perin (2011) points out, rigorous research is lacking on overall effectiveness, as well as on specific student populations, including English as Second Language (ESL) learners. In the context of NSC, other groups for whom data are lacking in regards to contextualized learning are veterans and the long-term unemployed. These are potential areas for further research, in which STEM Bridge is a viable intervention to examine.

Usage data reported to project staff from the Open Learning Initiative (OLI), where STEM Bridge is available for public use, showed that it has had over 11,000 users since its launch in 2013 (more than 80% of these were *STEM Readiness*). According to project staff, only about 12% of the users were NSC participants, the rest were from other colleges, high schools, and even middle schools. Because of its wide-ranging use, STEM Bridge is ripe for additional research into its impact on student achievement for various groups.

Table 1. Attributes of NSC Model Components

Component	Demonstrated successes	Potential challenges
Block scheduling	• Increased student focus • More time to complete assignments and lab in class • Ability to structure format like a work schedule • Increased retention	• Must fit into institution's scheduling system
Cohort enrollment	• Peer support/camaraderie building • Promotion of academic success • Similarities to workplace relationships • Streamlining of student progress tracking • Relationship-building between instructors and students • Encouragement of innovation in instruction (Hesse and Mason, 2005) • Increased hiring efficiency for employers	• Too many entry points can cause scheduling issues • Must have a communal focus; a cohort structure is not enough (Wathington et al., 2010) • Too few students in a cohort does not function well
Compressed classroom time	• Employment benefits to completing coursework quickly • Increased student performance on exams (Logan & Geltner, 2001; van Scyoc & Gleason, 1993) • Increased motivation (Daniel, 2000) • Increased student-faculty interaction and in-depth discussions (Daniel, 2000) • Students tend to prefer this format (Carley, 2002) • Decreased likelihood of course withdrawal (Beachler, 2003) • More opportunities for experiential activities (Daniel, 2000)	• Not enough time to cover essential material • Decreased student performance on exams (Joyce et al., 2015) • Too little time to complete assignments • Increased student stress (Daniel, 2000)
Employer linkages	• Increased student exposure to industry individuals and equipment • Increased likelihood that training is matched to industry needs • Increased job placement	• Substantial time investment • Potential cultural divide between industry and higher education (Adams, 2015) • Reluctance of employers to participate due to fear of proprietary information exposure (Adams, 2015)

Component	Demonstrated successes	Potential challenges
Hybrid delivery	• Students able to work at their own pace • Streamlining of grading and paperwork for instructors	• In-person, hands-on instruction necessary for some technical coursework • Some industry credentials require in-person and hands-on work • Instructors must be well-versed in the technology used for online training • Instructors must communicate frequently with students • Instructors must create a sense of community among online course students (Rausch & Crawford, 2012)
Navigator	• Related to increased retention and persistence (Rodgers et al., 2014) • Improvement of academic performance (Karp, 2011; Scrivener & Au, 2007) • Benefits more apparent in underprepared and disadvantaged students (Karp, 2011)	• More costly than traditional advising methods • Appropriate training must be provided to navigator (Karp, 2011) • Navigator must connect with student at the beginning of their program (Rodgers et al., 2014; Stebleton & Schmidt, 2010)
STEM Bridge	• Promotion of better academic performance • Modules adaptable to secondary and post-secondary students • Similar models linked to higher credit earnings, greater persistence, and increased program completion (Jenkins, et al., 2009)	• Not useful for students who do not need it • Development and integration costs could be high (Hamilton, 2013) • Unclear if certain groups are impacted differently (i.e., ESL students, veterans) (Perin, 2011)

Relationships
While each of these components have shown effectiveness within NSC and/or in the literature, applying a combination of the elements is even more promising. Interrelationships between the elements seem to help students succeed more than implementation of only one.

In the literature, cohort enrollment was often discussed as having relationships with other elements of the NSC model. There is a clear connection between cohorts and block scheduling, as an environment where the same group of students are taking the same courses in half-day or day-long blocks allows for more relationship building (Spaid & Duff, 2009). The implementation of a compressed program with a cohort has been shown to increase retention and graduation (Spaid & Duff, 2009). As discussed previously (see Cohort enrollment section), the literature highlights essential components of a cohort model, which create an environment that encourages team work, respect, and peer support. These benefits then allow for a more streamlined and less challenging progression through a compressed program.

A cohort model also has been linked to student success when combined with a hybrid delivery model. Rausch and Crawford (2012) developed a *Hybrid Learning Community Model*, which combines face-to-face classroom time with a virtual classroom and cohort-based learning, where the cohort is the ñkeystoneò of the structure. As with the relationship between cohorts and compressed time, the cohort community creates a sense of comfort that likely gives students the ability to better advance through the online course format. A cohort who has had some face-to-face time will likely interact more collaboratively in an online course, fostering successful academic performance and course completion.

NSC program staff typically named the navigator and cohort enrollment as the most important aspects of the model; however, they each pointed out that these are most effective in conjunction with the entire model. That said, prior research has linked these elements as a way to increase student retention. Stebleton and Schmidt (2010) reported that students in a Minnesota community college who were part of a learning community (cohort) and also participated in a counselor-led orientation course, which resembled the navigator model, had an 86% retention rate, compared to 70% retention rate of the overall student population. It is not clear if one portion was more effective than the other; however, they clearly worked together to facilitate retention.

Other research outlined several elements that should be used in order to help ensure college student success and to adequately meet their needs. Of these, items related to a student community (cohort) and intensive advising and information sharing were the most commonly mentioned (Fowler & Boylan, 2010; Karp, 2011; Stebleton & Schmidt, 2010). Karp (2011) named four aspects that foster better academic performance, persistence, and degree attainment among community college students, particularly academically underprepared students. The first is the creation of social relationships, for which a cohort can be an essential way of establishing connections in a community college setting. The remaining three; establishing educational goals, learning about the cultural and procedural environments of the college, and addressing external needs that could hinder studentsô ability to remain in school, are often a focus of a navigator. A one-on-one counselor can provide the tools to establish and maintain goals, share information on college processes, and act as a liaison between the student and external services that may be

needed. Therefore, this suggests that a cohort model, combined with the personalized support of a navigator, is an essential integration of components resulting in community college student success.

CONCLUSIONS

Focusing on the question guiding the research, *What is the promise of components of the NSC model on community college education?*, it appears the NSC model as a whole is an effective structure for student success overall and when broken into its components. That said, these components function more effectively when implemented together, and each institution must weigh several factors before choosing to implement one or more pieces of the model. These factors include available resources, demographics of the participating students, curricular content, and procedures and policies specific to the institution.

As identified by NSC program staff and the literature, a cohort model (i.e., learning community) and a navigator (i.e., one-on-one, intrusive advising) are essential elements for community college student success, in terms of academic performance, retention, and program completion. These facilitate a crucial support system composed of peers and staff that helps increase collaborative learning and reduce barriers to success. This is particularly appropriate for academically underprepared students, however, has the potential to benefit most types of students.

While the hybrid delivery model has been linked to student success as well, the appropriateness of this structure must be determined before implementation. Because NSC content was heavily technical and required substantial hands-on work, only a small portion of the curriculum was able to be delivered online. However, the research reported that online coursework fits well with a cohort model such as NSCôs, as long as in-person meetings occur at the beginning to help build relationships.

RECOMMENDATIONS FOR FURTHER RESEARCH

This review was a cursory look into the elements in community college settings; therefore, a more in-depth review of precious research, as well as new research would be beneficial to community colleges. The following are areas that would benefit from further research:

- *Block scheduling.* This format has been studied in secondary education settings, but little research has been done within the community college context. Because it is often seen as an element of the cohort model, it is usually discussed in that context. Therefore, there is a need to separate the two components and determine the effectiveness of each. A more in-depth look at how students perceive this structure and how it relates to their overall performance would help parse out its effects separate from the cohort model.

- *Success of various groups who participate in contextualized learning.* STEM Bridge and other types of contextualized developmental learning in community colleges appear to benefit students. However, it is not clear if this model effects certain groups of students differently, such as veterans and long-term unemployed. Studies on contextualized learning specifically targeting these groups, or other groups deemed underprepared, would add critical knowledge to the current body of research. Since STEM Bridge is online, with user analytics being continually tracked, opportunities may arise to look at groups like these, or groups in different settings, such as high schools or 4-year institutions.

- *Cohort enrollment and navigator relationship.* A more in-depth look at the interaction of the cohort model and the navigator would be beneficial. Because these two elements are resource-intensive, community colleges would gain important insights from more rigorous and in-depth research into how these items effect student outcomes, particularly academic performance over the course of a program; short-term student retention (term-to-term); credential, certificate, and degree completion; and subsequent employment or further education. As with contextualized learning, more focused research into effects on particularly groups would be revealing as well.

- *Suitability of compressed classroom time to content.* Based on literature and NSC program staff comments, compressed classroom time is not universally ideal for community college programs. Careful consideration must be made of the amount of material covered, the difficulty of content, and industry credentialing before restructuring curricula into a condensed timeframe. A more comprehensive examination into what types of content are more appropriate for compressed timelines would help guide community college staff and faculty when making decisions regarding structural changes.

- *Resources needed for implementation.* All of the model elements explored here require additional resources, including funding and staffing, to develop and maintain. A review of implementers of these elements to discern typical costs and needs, within different contexts, would give staff and faculty more information to use when communicating with the institution decision-makers about these different formats.

- *Investigate employment and further education outcomes.* Most research regarding these model elements reported on student success in terms of academic performance, retention, and completion. We recommend taking this a step further to look at employment outcomes, such as whether or not students became employed after completion and if they retained that employment. This is especially useful for short-term certificate programs focused on workforce development, and because so many unemployed and underemployed are attending community colleges, the information is needed to continue to tailor programs to suit their needs. Additionally, tracking a studentôs academic progress if they move on to further education, such as a 4-year degree, could also shed new light on the impact of the model elements.

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APPENDIX. PROJECT STAFF COMPONENT INTERVIEW PROTOCOL

NSC TAACCCT Grant Evaluation–Year 4
Component Interview Protocol

Format	Semi-structured interview protocol outlines pre-determined questions, and allows the interviewer to probe and pursue unplanned tangents as conversations warrant. Respondents will be recruited via email.
Targets	Respondents will be NSC program coordinators.
Evaluation Question	Interview questions will address the following evaluation questions: 4. What impact did the NSC program components have on consortium colleges in terms of program and course offerings, student enrollment, and college processes? 6. What is the promise of components of the NSC model on community college education?
Timeline	Interviews will take approximately 20-30 minutes and will be conducted by telephone in July/August 2015.

Initial Recruiting Email
The National STEM Consortium (NSC) has partnered with Hezel Associates, a research firm in Syracuse, NY, to conduct the independent evaluation of Year 4 of the USDOL TAACCCT Round 1 grant.

As a part of our responsibilities, we will be conducting phone interviews with representatives from the NSC programs to delve deeper into the NSC model components (i.e., cohort enrollment, navigator). You have been selected as a potential participant due to your involvement in NSC.

Telephone interviews will require 20-30 minutes. We are scheduling interviews between [specify date range]. Please respond to this email with times and dates if you are available to participate in an interview during this timeframe. We will send you a return email confirming your scheduled interview.

This evaluation is being coordinated with Susan Gallagher, NSC Project Director, at Anne Arundel Community College. If you have any questions about the evaluation or interviews, she can be reached by email at sgallagher5@aacc.edu. You are also welcome to contact me if you need more specific information regarding details of the evaluation study.

Thank you for your support.
Sincerely,
[SIGNATURE OF SENDER]

Pre-Interview Confirmation (via email), with Informed Consent Attachment
Thank you for agreeing to participate in the NSC grant evaluation process.

Your interview has been scheduled for:
[INSERT DATE / TIME]

We will call you at [INSERT PHONE #]. We expect the interview will last 20 to 30 minutes.

Your individual responses will be kept confidential and aggregated for the report. No personally identifying information will be reported, and we will make every effort to protect your identity when we present our findings. Please review the Informed Consent document attached to this email prior to the interview.

If you have any questions about the evaluation or your participation feel free to contact me, Susan Gallagher, or you may email Solutions IRB (our external review board charged with ensuring we treat evaluation study participants ethically) at participants@solutionsirb.com.

Thank you for your participation,
[SIGNATURE OF SENDER]

Interview Instructions
ITEMS IN ITALICS SHOULD NOT BE READ TO INTERVIEWEE

Phone Interview Introduction
Hello, this is _____ from Hezel Associates. Iôm calling about the interview we have scheduled to discuss your involvement with the NSC project at [*college*].

Is now still a convenient time to talk?
As a reminder, your responses will be kept confidential and aggregated for the report. No personally identifying information will be reported, and we will make every effort to protect your identity when we present our findings. You can stop the interview at any time and skip any questions you are not comfortable answering. You can also choose to withdraw your responses.

Have you read the informed consent document that was emailed to you?
IF NOT, GO OVER THE MAJOR SECTIONS WITH THEM, ESPECIALLY BENEFITS AND RISKS.

Do you have any questions concerning the consent form or the study?

Do you agree to participate in the interview?

I would like to record our interview to support my note-taking, and the recording will not be used for any other purpose. May I have your permission to record our conversation?
IF PARTICIPANT DECLINES RECORDING, RESEARCHER WILL TAKE NOTES.

Components:
1. STEM Bridge
2. Navigator
3. Cohort enrollment
4. Block scheduling
5. Compressed classroom time
6. Hybrid delivery
7. Employer linkages

Questions

Implementation

*Questions 1-6: probe for **implementation changes** over grant period; **challenges to implementation***

1. Was STEM Bridge (STEM Readiness and/or STEM Foundations) required by all students for their technical track?
   If not, who determined if they were required or not?

2. How was the navigator position structured?

3. Was the cohort model implemented? What did it look like?

4. Did you implement block scheduling? What did it look like?

5. What did the compressed classroom time (condensed schedule) for the technical track(s) look like?

6. How was a hybrid delivery (a mix of in-person and online instruction) incorporated into the curriculum? Were there differences between technical tracks (*if applicable*)?

7. How have your employer relationships changed from when the grant started until now?

8. What were the challenges to establishing and maintaining employer partnerships?

Model

9. If you were only able to implement three elements, which would you choose and why?

10. Are there any that seem to work better if used in concert with one another in order for students to succeed (in terms of retention, completion, and/or employment)? Any that can stand alone to help achieve student success?

11. Do any elements particularly help one group better than others, in terms of retention, completion, and/or employment?
    (*Examples: Veterans, TAA, long-term unemployed, underemployed*)