FEATURE ARTICLE

Corequisite Developmental Mathematics: Faculty Input on Challenges and Positive Outcomes

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ABSTRACT

Corequisite mathematics is a developmental education intervention designed to provide the instruction of college-level math content while concurrently requiring student participation in learning support. Its purpose is to facilitate underprepared mathematics students in expeditiously completing their college gateway math requirements. This model has been promoted, and in some cases, mandated as a means of reforming math instruction for underprepared college students. A fundamental design principle of the corequisite model is integrated learning support. Pedagogy is focused on course content, as well as concurrent skills instruction to support the student learning process. This integration of learning support with course content and instruction requires more student time on task in the short term, with the goal of reducing their overall time spent in developmental education to (typically) one semester. As corequisite reform is being broadly applied in American colleges, this study sought to examine the experiences of those teaching these courses. Analyzing survey data received from 42 faculty members who teach corequisite developmental mathematics (CDM), we identified 10 challenges faculty encountered when teaching CDM courses, as well as five positive outcomes of CDM at their institution. Based on findings, we offered practical implications for future practice in CDM implementation.

Keywords: corequisite developmental mathematics, corequisite model, acceleration, developmental mathematics, developmental education.

Over the course of U.S. higher education history, there has consistently been a need to provide support for underprepared students. The purpose is to close the gaps between what students are expected to know at the outset of entering college courses, and what they actually know. Over time, and through various iterations, developmental education has been applied as a solution to student underpreparedness for college. During the post-civil rights era, developmental education shifted from preparatory college programs and remedial courses to a more comprehensive design aimed at providing support and services that encourage student academic and personal growth (Boylan, 1995). How developmental education has been implemented is as diverse as the students served. The controversial nature of developmental education programs (i.e., programs not wholly devoted to the instruction of college-level content) also weighs into the varying approaches that states and colleges have applied in service to underprepared students. Research shows that students who complete developmental courses typically do well in college-level courses compared to those underprepared students who enrolled directly in their college-level courses (Wolfle, 2012). However, many students do not finish their developmental course requirements, especially in mathematics (Bonham & Boylan, 2012). Factors such as failing a developmental course and the amount of time spent in a developmental sequence of courses are associated with higher student dropout rates (Jaggars et al., 2014). As a result, accelerated developmental education is currently being widely applied as an option to help students complete their developmental coursework in a timely manner, thus reducing possible drop-out points for students (Jaggars et al., 2014; Nodine et al., 2013).

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Recently, the trend of accelerated developmental education has moved headstrong toward the application of corequisite courses. With the passing of Senate Bill 1720 in Florida (2013), developmental education was made optional for students. Despite being optional, developmental courses still had to be offered in an accelerated manner. Colleges were instructed to try from among contextualized, modularized, compressed, or corequisite models (Hu, 2019). In the 2015–16 academic year, Mokher et al. (2021) examined the influence of these four models over the course of three years in 28 Florida public colleges. Their findings revealed that the corequisite mathematics model in a developmental education optional environment provided a higher probability of success for completion of gateway mathematics courses by students choosing it. Some states, such as Texas and Tennessee, have mandated the use of a corequisite model to replace standalone developmental education courses either partially or completely. Further, it has been reported that a consortium of 46 states, college systems, and U.S. territories have committed to applying corequisite developmental education as a reform initiative (Saxon et al., 2020). Corequisite developmental education has been promoted by advocacy groups and appears to have been deployed quite widely in recent years. Two highly touted benefits of corequisite courses according to proponents are that the developmental education intervention is accelerated, and that students can attain college-level degree credit immediately while engaging in college-level skills development (Complete College America, 2021).

However, it is not readily apparent how corequisite mathematics is working as a solution. Foster et al. (2022) described corequisite reform as having likely been based on the efficacy of the Accelerated Learning Program (ALP, 2024) at one particular college. The content in this application was English/writing and the model was designed meticulously, employing best practices such as small class sizes, mainstreamed student enrollment, and integrated learning support taught by the same instructor as that of the content course. However, as corequisite developmental education has been applied to the instruction of mathematics, and scaled nationally, it is unlikely that the unique and effective practices applied in ALP have been brought along in totality. As Foster et al. (2022) noted, "Whereas ALP serves as the predominant model for the English community, there does not appear to be a comparable distinguished model for the mathematics community" (p. 17).

With the growing number of institutions moving towards a corequisite model as a form of developmental education, it is critical to gain insight into all aspects of the model from various sources. Although research pertaining to success and faculty perceptions in accelerated developmental mathematics has surfaced in recent years, there still remains a gap in the literature pertaining to faculty insights for the corequisite model. A critical component of understanding the nature and impact of corequisite courses may be seen through the lens of the faculty who teach them. The faculty teaching corequisite courses have first-hand insight as to the challenges and opportunities that they offer. Yet there is little known about what faculty have experienced in this regard. Therefore, the purpose of this study was to understand the challenges and positive outcomes of corequisite courses as viewed from the perceptions of faculty members teaching them.

Literature Review

Though much has been written about corequisite courses, there is limited information regarding faculty perceptions of them. As faculty are likely the most integral component to student success in corequisite courses, it is important to understand what they perceive to be working and what opportunities there are for improvement. This review explored some of the efficacy research on corequisite mathematics and presents the limited research available regarding the perspectives of faculty who teach remedial, developmental education, corequisite, and other accelerated skills and content courses.

Corequisite Developmental Mathematics

There is a growing body of research pertaining to corequisite developmental mathematics efficacy (in various math content areas) that examines measures such as student performance, pass rates, and the completion of developmental and gateway mathematics courses. Generally, the student success outcomes results are mixed. Anderson et al. (2020) found that students in a corequisite developmental mathematics model were three times more likely to pass their developmental (support) course compared to their peers in a traditional developmental mathematics sequence. Moreover, Kashyap and Mathew (2017) examined the impact of three approaches to success (i.e., direct enrollment in gateway course, corequisite model, and prerequisite developmental model) for a freshman level quantitative reasoning (QR) course. They reported that students in the corequisite QR course had higher grades than those in the prerequisite course. Similarly, Royer and Baker (2018) found that students in corequisite QR courses completed at higher rates than those in a traditional sequence; however, the transition to corequisite at the institution of study was done concurrently with a redesign to a pathways model. A salient feature of pathways models is that math content is contextualized based

on student's major discipline. Therefore, it should be considered that this feature may have precluded a like comparison of the two instructional models. Three other reports examined short-, medium-, and long-term outcomes of randomly assigned students to elementary algebra, elementary algebra corequisite, and statistics corequisite classes (Douglas et al., 2023; Logue et al., 2016; Logue et al., 2019). They concluded similarly that corequisite students were succeeding at higher levels than those in a traditional sequence. However, caution should be noted when making comparisons due to substantial mathematics course content changes and associated adoption of the corequisite model.

In a study of corequisite developmental mathematics and traditional developmental mathematics, Minsu et al. (2018) found that students in the traditional (standalone) course were more likely to receive an A grade than those in corequisite courses. However, students in corequisite courses showed more improvement and higher pass rates than their counterparts in the traditional sequence. Finally, Campbell and Cintron (2018) noted that students in corequisite mathematics had a lower percentage of noncompletion in their corequisite support (developmental) course than their counterparts in the traditional developmental sequence.

When comparing completion rates in gateway courses, Atkins and Beggs (2017) cited similar completion rates among those who began either corequisite developmental mathematics (78.8%) and prerequisite developmental mathematics (75%). Similarly, Campbell and Cintron (2018) found no statistically significant difference in completion rates of college-level mathematics courses when comparing a traditional developmental mathematics model to a corequisite developmental mathematics model. However, Shields and O'Dwyer (2017) noted that students who took three or more developmental courses had a 13% lower probability of transferring to a four-year degree program and earning a degree.

Ran and Lin (2022) conducted a study on the effects of first-time college students' outcomes in mathematics when placed in a prerequisite developmental course, a corequisite course, or a college-level course for students near the college-readiness standard. They found that prerequisite developmental courses had a negative impact on math gateway course completion, but students who were placed in corequisite or gateway courses had similar completion rates. The authors went on to describe, however, that corequisite courses could not be attributed to any significant change in longer term student success outcomes. Perhaps this is noteworthy as advocacy groups pitched this model as a solution to underprepared students leaving college without a credential (CCA, 2012).

Ran and Lee (2024) conducted a follow-up study of first-time college students' longer term success outcomes after participating in mandated corequisite mathematics. They examined data from Tennessee community colleges from 2010 to 2020. Gateway and next college-level course completions were stronger for all mathematics students, but the effects were stronger for those with higher placement test scores. However, the authors reported that the Tennessee corequisite reform has failed to produce efficacy in long-term student success measures. It was suggested that the mandate may have been harmful to students of lower academic skill levels. Generally, students that were assessed as needing remediation were 8.1% more prone to drop out than those who participated in a prerequisite developmental education traditional sequence. These students were also 28.8% less likely to earn a credential. The authors added, "While the effects on gateway course completion were positive across the full spectrum of placement test score distributions, the negative effects on enrollment persistence and credential completion were primarily driven by students coming in with the lowest scores" (Ran & Lee, 2024, p. 4).

Fundamental to the appeal of the corequisite mathematics model is that it accelerates students' skills development.

Fundamental to the appeal of the corequisite mathematics model is that it accelerates students' skills development. The nuance of the impact of this on students, however, is rarely discussed in the literature. Only a few studies were recently located that addressed the issue (Saxon & Martirosyan, 2023). The acceleration occurs in the time continuum, giving students the opportunity to attain college level mathematics skills during the first semester that they engage in a corequisite course. Time on task, however, is a different matter. Corequisite courses require weekly attendance in both a content and a support course. Therefore, students can easily spend double the time weekly in corequisite courses than they would a traditional prerequisite course. This means that perhaps students participating in corequisite courses will need to forgo at least one other class on their schedule in

order to support their success in developing mathematics skills. This slows their progress to degree attainment, which was a criticism of prerequisite developmental education (CCA, 2012). Furthermore, it is unlikely that the support course offers degree credit while increasing tuition and fees. These too, were also criticisms of prerequisite developmental education (CCA, 2012).

How much the increase in weekly time on task that is required, however, is not uniformly defined. For example, Buckles et al. (2019) described corequisite support courses that required 1 to 3 credit hours, essentially adding nearly 1 to 3 hours of instructional time per week. Saxon and Martirosyan (2023) reported that the majority of teachers described their corequisite courses (content and support combined) as being more than 5 credit hours, with some as high as 7 credit hours.

> The support component requires more student commitment in terms of time and effort. Though there are benefits to offering it simultaneously with a college credit course, the support requirement nonetheless could be subject to similar criticisms as traditional developmental courses. Therefore, a goal for institutions offering CDM is to find the appropriate level of support and content that the student needs, taking into account cost and course load for the student. (Martirosyan, 2023, p. 23)

Faculty Perceptions

Unfortunately, the literature pertaining to faculty perceptions regarding developmental mathematics instruction and instructional models is limited. The few studies located on this topic included work that explored faculty perceptions on accelerated (typically modularized or 7.5 week courses) developmental mathematics models (Booth et al., 2014; Cafarella, 2016; Saxon & Martirosyan, 2020), a compressed model (Cafarella, 2016), corequisite mathematics (Campbell & Cintron, 2018; Kashyap & Mathew, 2017; Royer & Baker, 2018), and developmental mathematics in general (Zientek et al., 2014). In these studies, researchers identified positive and negative outcomes associated with the implementation of particular developmental mathematics instructional models.

Generally, student motivation in developmental mathematics courses (Zientek et al., 2014) and student buy-in to participating in a corequisite model (Campbell & Cintron, 2018) were cited as challenges. Booth et al. (2014) noted that developmental course instructors felt that accelerating developmental education was not beneficial for students who were lacking in motivation and commitment. Zientek et al. (2014) explored developmental mathematics faculty perceptions on placement and student success. Instructors in the study cited an absence of students' basic skills as being a hindrance to their success. In Cafarella's (2016) study on acceleration and compressed developmental mathematics courses, instructors emphasized that incoming student skill level and learning style play pivotal roles as to whether a compressed or accelerated developmental mathematics sequence was best for them. Saxon and Martirosyan (2020) reported that accelerated developmental mathematics faculty felt that their students had an improved attitude towards mathematics courses due, in part, to the opportunity to enroll in their college-level courses more quickly.

An area showing mixed results is that of the acceleration of student skills development. Developmental mathematics instructors have said that accelerated developmental math courses have been successful at decreasing the time students spend in developmental education (Saxon & Martirosyan, 2020). Similarly, Kashyap and Mathew (2017) explored the effects of a corequisite model (their accelerated model) on QR courses. Instructors in their study stated, "We felt students were less rushed and more relaxed with course materials in the corequisite model" (p. 27). Conversely, acceleration has also been cited as a factor that negatively impacts student skills development (Zientek et al., 2014). Concerns have been raised that with a shortened developmental sequence, students do not have as much time to adequately develop their skills, thus threatening their chances of college-level course success (Jaggars et al., 2014).

Other themes addressed in the faculty perceptions literature were those of student retention, class attendance, and stigmatization. Accelerated developmental mathematics faculty believed that a shorter course sequence has positively contributed to student retention due to the decrease in exit points and the ability to move on to their college-level course more quickly (Saxon & Martirosyan, 2020). However, others have stated their belief that a student's failure to attend class can have an exacerbated negative impact on success, as they will miss relatively more instruction and content per class in an accelerated structure (Campbell & Cintron, 2018; Zientek et al., 2014). Royer and Baker (2018) cited faculty who described traditional developmental mathematics courses as contributing to what they called "math shame" (p. 34). That is, the content level and stigma associated with mathematics courses that were not college level was felt and experienced by the students therein. It was argued that by simply placing students in college-level math, the students and faculty believed they were ready for college mathematics.

Some studies have mentioned challenges related to accelerated and corequisite instruction that were experienced by the faculty members. One of those concerns was the lack of support and training for designing and delivering accelerated developmental mathematics courses (Saxon & Martirosyan, 2020). Other challenges noted were a lack of faculty ability and/or willingness to teach both college-level and developmental courses (Campbell & Cintron, 2018). As noted, instructor consistency across corequisite content and support courses was a touted characteristic of the successful ALP (2024) model, upon which this reform was likely based. Furthermore, some instructors experienced a low comfort level in designing, preparing for, and teaching accelerated courses (Cafarella, 2016). Cafarella (2016) concluded from his research of faculty perceptions that there is not a one-size-fits-all approach to developmental mathematics. As such, faculty input can provide critical insights into creating successful developmental courses using various models and structures. Thus, this research pertaining to faculty perceptions of corequisite developmental mathematics implementation may be helpful.

As such, faculty input can provide critical insights into creating successful developmental courses using various models and structures.

Method

In this study, a subset of data from the Corequisite Developmental Mathematics (CDM) Survey (Saxon & Martirosyan, 2023) was examined. Qualitative responses to two open-ended questions were used to address the following research questions: (a) What challenges did faculty members encounter when teaching their corequisite mathematics courses (b) What were the positive outcomes of corequisite mathematics as perceived by faculty teaching those courses?

Population and Sample

Participants of this study were attendees of the 2021 National Math Summit hosted by the National Organization for Student Success (NOSS). These participants were highly likely to be involved in corequisite mathematics instruction, as much of the event focused on this topic. A total of 203 attendees were invited to complete the CDM online survey. Of those, 67 responded, which indicated a 33% response rate. The first survey question inquired as to whether the participant taught a CDM course or not. Of the 67 participants, 42 indicated that they taught a CDM course. Those indicating that they taught a CDM course were then offered access to the complete survey. Those who had not taught a CDM course (*n*=25) were thanked for their willingness to engage with the survey but were not offered further survey access.

The majority of the participating faculty (*n*=30) were teachers at 2-year colleges. The remainder (*n*=12) were at 4-year colleges. They taught CDM for underprepared students (27%), CDM "mainstreamed" (a combination of underprepared and college-ready students) (35%), and CDM academic support classes (38%). A broad distribution of class sizes were evident. Twenty-nine percent reported smaller class sizes (8–12 students). Twenty-six percent reported class sizes of 12-18 students. Twenty-nine percent reported larger classes (18–24 students) and 12% reported classes of more than 25 students. Nearly 60% of the respondents stated that their CDM combined credit-hour count (content and support courses) was more than 5 credit hours—some were as high as 7 credit hours. Corequisite content classes and their support courses were not always taught by the same instructor. Indeed, only 29% of the participants always used the same instructor and approximately half of the participants (52%) sometimes used the same instructor.

Instrument and Data Collection

The CDM survey (Saxon & Martirosyan, 2023) consisted of 21 items focused on faculty characteristics (e.g., teaching status and content area of expertise) and various aspects of CDM implementation (e.g., challenges, positive outcomes, instructional practices, and support services). Before data collection, the survey was pilot tested for clarity among several corequisite mathematics faculty members. The research study and survey were then described and introduced to potential participants during a session at NOSS's National Mathematics Summit (https://thenoss.org/Math-Summit). It was also emailed to all registered attendees. They were given 2 weeks to complete the survey, and two reminders were sent before closing it.

Data Analysis

Data on two open-ended questions in the survey were examined in this study. Qualitative data responses were coded and analyzed. One of the researchers coded data using a content analysis

approach (Krippendorff, 2013). The second researcher cross-checked coded data to ensure the accuracy of coding. In most cases, participants were very specific when listing challenges and positive outcomes, which resulted in emergent themes after the first round of coding.

Results

Participants were asked to list up to three challenges they have encountered when teaching their corequisite mathematics courses. They were also asked to list up to three positive outcomes of corequisite mathematics at their college. Both questions were open-ended. The 42 participants provided a total of 77 data points for the *Challenges* item, and 74 data points for the *Positive Outcomes* item. Emergent themes for both items are displayed in Table 1.

Table 1
Emergent Themes

Survey Item	Themes
Challenges	Engagement
	Attendance
	Time
	Underpreparedness
	Different instructor
	Pace
	Workload
	Modality
	Technology issues
	Lack of study skills
Positive outcomes	Student performance
	Self-confidence
	Shorter time
	Engagement
	Alignment and support

Challenges

Ten themes emerged from the participants' responses to the question regarding challenges encountered in teaching corequisite mathematics (see Table 1). Themes were sorted for frequency. Details on each theme are presented.

Engagement and Attendance

Student engagement and attendance were the most common challenges identified. In addition to simply stating these as challenges, several participants noted that it was challenging to get "students to engage with each other during group activities." Faculty reported a "lack of participation." They further noted that it was difficult to have "students stay focused throughout both courses." Additionally, "students quit attending."

Time

The increased time on task expectations of corequisite courses seemed to create a challenge for students. For example, faculty reported that students perceived the addition of a support course added "a lot of time for [them]." Students who "struggle" are "force[d] into 6 hours of that subject a week" and do not have "enough time to process course material." Also, as the support course added "a lot of time for students," they "think the support course should just be a homework help." Closely related, a lack of student time management skills was also cited as a challenge.

Underpreparedness

Unsurprisingly, student underpreparedness was a theme that emerged from the data. Student "lack of preparedness mathematically" and in general for "college level work" were noted as challenges. In addition, instructors described low student motivation that likely stemmed from their lack of preparedness for college studies. It was noted that some students were "so underprepared" that "they have difficulty getting caught up even with the supplements." Their "fear of math" and "making mistakes in front of others" were added challenges that made it difficult in "getting students to try and complete homework."

Different Instructors

Assigning different instructors for content and support courses presented another challenge. The primary issue in this regard was the lack of communication between "cooperating" instructors, which ultimately affected students' perception of corequisite courses. Additionally, students perceived the corequisite support course as "another" math class. Moreover, having instructors with different teaching styles may have added to the challenges, as this was cited as contributing to students being confused. Thus, content and academic support integration was adversely affected by having different instructors teaching the two courses. One participant noted that when instructors do not teach both the support and college-level classes, then the support class is "more generic." On the other hand, when the same instructor teaches both courses, they "[make] more changes to the lesson plans" to accommodate students who "struggle more." An instructor explained that, to avoid "content misalignment," it was necessary to "make the content relevant to what they are learning in the gateway."

Pace, Workload, and Modality

Corequisite course pace, workload, and modality were reported to be challenging for some students. Because of the amount of material to be

covered, "students often feel overwhelmed by the pace of the course." It was "too fast" and "too much content for some students to absorb," and therefore, students struggled with content mastery. Additionally, for those teaching online and not having the opportunity to meet face-to-face, there were more "problems" than for those who taught the "face-to-face" modality. The extent to which corequisite mathematics is taught online is not known. In this instance, some online delivery may have been an overhang from COVID-19, when many institutions were forced to switch to online course delivery.

Technology Issues and Lack of Study Skills

Challenges faced by students included a lack of reliable Internet access and other "technology issues" that seemed related to finances. Due to financial hardships, some students did not have access to their required online technology-based course platform for learning mathematics. Even the purchase of a calculator was cited as a financial challenge for some students. More broadly, instructors also mentioned that many students lacked self-confidence and study skills, which consequently adversely impacted their work with technology, and in completing their assignments inside and outside of class.

Positive Outcomes

Five themes emerged from the participants' responses on the positive outcomes of corequisite mathematics at their institutions (see Table 1). These outcomes were ranked for frequency.

Student Performance

Student performance was the top theme present in the positive outcomes data. Two categories that emerged were pass rates and achieving better grades. Participants reported "higher passing rates for the college level course compared to the old sequential developmental model." More students were passing and staying in college. This was "due in large part to cooperation between the college level and the dev[elopmental] teacher." It was noted that "some students have said [they] would not pass gateway without co-requisite." Often, students in corequisite classes had improved or higher grades, pass rates were good, more students were getting through and "less students [were] stuck in developmental classes." Overall, increased student success was reported by instructors teaching corequisite mathematics courses.

Self-confidence

Increased student self-confidence was reported by many of the instructors teaching CDM courses. Students felt more confident and "comfortable asking the co-req[uisite] teacher questions that they would not ask in the regular class setting." They also felt "better about the course and themselves" and had better attitudes. Instructors noted a positive change in attitudes and described that students were building self-confidence over time. Indeed, students were "willing to admit mistakes and move forward without having negative feelings." Moreover, when students were successful, "they felt more able to handle other college level courses."

Having the opportunity to pass two courses in one semester allowed dedicated students to finish their gateway mathematics requirements in a shorter amount of time.

Shorter Time

Corequisite courses saved time for students. Having the opportunity to pass two courses in one semester allowed dedicated students to finish their gateway mathematics requirements in a shorter amount of time. Thus, they were able "to get through their math requirements quickly." As might be expected, "getting through a college level course in less time" contributed to student retention as well. As one participant noted, "students are able to see a way to complete their required math courses in a reasonable amount of time."

Engagement

Student engagement was reported as a positive outcome by several of the participants. Because of the number of class days (e.g., some reported meeting 5 days weekly, with 3 class and 2 lab days), there were more opportunities for student-student and instructor-student interactions. Therefore, students were "involved more" and there was evidence of "collaborative work that is built naturally." It was evident that students were "glad to have support and [a] safe space to ask more questions."

Alignment and Support

The final theme in the data was the alignment and availability of student support resources. Instructors noted that there was a better "co-req[uisite] alignment with the college course." Additionally, with corequisite courses, resources were available to "provide direct academic support" to all students. The academic support was instrumental in "moving more students through credit courses." As a result, students were also able

to understand the material better and, therefore, persisted and completed their courses.

Discussion and Implications for Practice

Various approaches have been offered to help academically underprepared students' progress to and through college gateway courses. The rise of corequisite reform can be, to some extent, attributed to mismanaged developmental education course sequences. It seems three-level sequences have been difficult for students to navigate (Bailey et al., 2009), and administrative and advising systems have not been designed properly so as to effectively manage matriculation through them. Furthermore, students relegated to multiple levels of developmental courses are obviously in need of substantial remediation, as well as academic and noncognitive support. The odds of success for these students are quite low and the faculty involved in this study have expressed that perhaps even corequisite courses are not properly designed to serve them.

Time, Course Pace, and Advising

A potential pitfall of corequisite courses, according to those that teach them, relates to the accelerated instruction characteristic of the model. For corequisite courses, students must enroll in substantially more credit hours and therefore engage in more daily and weekly time on task than the typical standalone developmental course. Saxon and Martirosyan (2023) reported that nearly 60% of corequisite courses required enrollment in 5 or more credit hours. Furthermore, the pace of the classes must move expeditiously so that the gateway class content can be covered completely in one semester. As such, attendance is important. At a minimum, students who are encouraged to enroll in corequisite courses should be advised accordingly regarding the amount of time that will need to be invested and the pace at which the class will proceed.

Instructor Impact on Integrated Content and Learning Support

Faculty described the challenge of having different instructors teach the content and support course. As noted, a primary feature attributed to the effectiveness of the ALP corequisite model was the use of the same instructor for both courses (ALP, 2024). If this is not done, then the onus resides with the two instructors to communicate and collaborate with each other consistently throughout the design and delivery of the courses. It is important that academic support be integrated with the more difficult college-level math content being taught. It is also important that the content course instructor reinforce time management and study skills, as these are best practices in adult teaching and learning for underprepared students (Boylan, 2002). Generally, if the same instructor cannot be assigned to both components of the corequisite course, the two instructors need to work collaboratively to effectively integrate the content and support courses.

Pros and Cons of Corequisite Courses on Student Engagement

Interestingly, student engagement was reported by faculty to be both a challenge and a positive outcome. Some specific engagement challenges cited were low class attendance, lack of attention in class, lack of contributions in class work and discussion, and low interaction with classmates. Survey participants went on to note that these challenges were related to the increased time spent in classes. Generally, spending time in two classes related to one topic seemed lengthy to students. As a result, it was a challenge to keep them focused and working throughout class time. For some students, it led to their withdrawal from the classes. This is consistent with the literature for developmental education courses in which student motivation (Zientek et al., 2014) and buy-in to engaging in a corequisite course were found to be challenges. Furthermore, faculty have stated the negative impact low attendance can have on student success (Campbell & Cintron, 2018; Zientek et al., 2014).

Conversely, student engagement was also reported as a positive outcome of corequisite courses. The lengthy classes and multiple meetings weekly seemed to be a benefit for some students. The faculty believed that this allowed for more student interaction and collaborative learning opportunities. It is likely that for these students, stronger connections were made with the instructor, their peers, and the content.

Indeed, enrolling in two classes and spending substantially more time on a particular subject daily and weekly throughout a semester will present both positive and challenging student outcomes with regard to engagement. Therefore, it should be considered that advising and proper student course placement can assist in sorting out for whom the intervention may work best. At a minimum, students potentially being placed in corequisite courses should be advised about the substantial time commitment that will be required to succeed in the two classes. They should also be advised of the benefits of committing to and engaging in such an endeavor. If it seems overwhelming to them, other developmental education courses or support options should be made available. As Campbell and Cintron (2018) recommended, having a mandatory orientation for

students participating in the pilot to go over expectations and making attendance and advising a requirement for course completion should be considered.

Study Skills Instruction

Some faculty expressed a concern about students in corequisite courses lacking the study skills that they believed were necessary for their success. The need to offer study skills instruction is a common recommendation for underprepared students in college. Boylan (2002) recommended the instruction of study skills as part of a core of support services that should be systematically available to underprepared students. Given the pace at which corequisite courses proceed, study skills should be taught upfront and throughout the course experience. These skills can be taught primarily in the support course, however, they should be demonstrated and reinforced in the content instruction class as well.

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Technology Issues

Faculty also expressed concerns about the application of instructional technology in the corequisite course. Specifically, the concerns seemed related to whether or not they can afford to access it. Advisors and instructors cannot assume that students can afford additional class expenditures for technology-based course applications and hardware. Therefore, students should receive advising prior to enrolling in courses that require the purchase of instructional software, calculators, and perhaps even Internet access. At a minimum, students should be advised about technology requirements and their costs. Where possible, colleges should offer these at no additional cost to students.

On a positive note, some faculty believed that corequisite courses showed the potential to improve student performance in mathematics. They believed that the pathways' content alignment with disciplines and majors, as well as the integrated and required learning support, were key components of this success. Furthermore, faculty saw an increase in self-confidence as students were no longer relegated to pre-college courses and content. This confidence manifested itself in student engagement in the courses and with their peers and the content. Ultimately, faculty saw that some students achieved college readiness in a shorter time frame than traditional developmental course sequences.

Overall, faculty perceptions regarding educational reform efforts are important considerations. The corequisite reform that was fervently pitched as a solution for underprepared student success obviously can work for some students but is not without challenges. As this sweeping reform was being implemented, Lane et al. (2020) asked a broad sample of faculty (*n*=1512) to consider their attitudes regarding the influence of developmental education reform. About 37% of those participants perceived that current developmental education reforms were lowering/or would lower academic standards. Only about 21% believed that current reforms were raising/or would raise academic standards. Thirty percent did not know or were not sure if there was an effect, and the remainder (12%) of the faculty did not think there was an effect.

Because instructor perceptions underpin teaching efforts, understanding these perceptions as they relate to corequisite reform is an important consideration. In many states and colleges, this reform has been mandated. It was not necessarily the choice of teachers to adopt corequisite developmental education. Calkins and Seidler (2011) noted that what instructors believe about why their course matters, what students should learn, how students should develop therein, and the type of reflective judgments they expect students to gain, have significant implications on how they think about teaching and, subsequently, how they teach.

Limitations

Generalizations made from this study may be inaccurate as a result of sample selection bias. The sample was limited to a group of what were professionals that were likely committed to learning about and improving their corequisite teaching skills, as they were all engaged in a professional developmental event related to corequisite mathematics. It is also likely that most faculty were supported by their institutions to attend the event. Therefore, the sample did not include many faculty relegated to teaching corequisite courses that may have lower commitment and motivation levels for doing so, and/or may have received less training and support from their institutions in implementing the reform. Perhaps faculty in other settings would hold differing perceptions about corequisite instruction challenges and outcomes.

The study results may also reflect participant response bias. It was assumed that participants offered honest and accurate answers in the survey, however, it cannot be ascertained that this was the case. Furthermore, responses were limited to only those event participants possessing the motivation to complete the survey. Additionally, participants were limited to three responses per question. Therefore, they may have been limited in providing richness and context in their responses. These limitations may have contributed to biased or incomplete responses.

Conclusion

In this study, we have sought to understand the challenges and positive outcomes of recent corequisite developmental mathematics reform from the perspective of those teaching them. The reason for doing so stems from the belief that the faculty involved in this reform work would know much more about its actual performance than the pundits and political advocates that have pushed it on the field. Corequisite mathematics was pitched as a promising practice that would result in improved student outcomes. It seems that this is occurring, but only in part. It is not a panacea for all underprepared students. From this, and other work, it appears that the field could do a better job of sorting out which students can benefit from this intervention. College administrators and faculty could likely do a better job of designing and delivering corequisite courses according to the principles of the ALP (2024) corequisite model, best practices in developmental education and learning support, and the principles of adult learning. It should also be recognized that transforming broad swaths of developmental education courses and support services into integrated instruction with concurrent learning support demands a substantial amount of time, effort, and resources. If done properly, it can be expected that many underprepared students can attain college-level skills proficiency and do so in a reduced amount of time. However, we know that this was also the case with prerequisite developmental education that was designed and administered properly. The mission of developmental education is to meet students where they are academically and affectively. Then, offer support and instruction so that they can succeed in their college level courses.

Classic research by Boylan and Bonham (1992) showed the efficacy of prerequisite developmental education at meeting this mission. Recent research by Ran and Lee (2024) supports that corequisite mathematics courses can serve the mission effectively as well—but only for those students who enter college adequately skilled as such to be placed in college-level courses with academic support. That is, as the authors describe, those who place "…just below the college-readiness threshold" (Ran & Lee, 2024, p. 4). However, the notion that developmental education and corequisite reform could be strong contributors to long-term success measures such as graduation and transfer is not panning out as advocacy groups such as CCA (2012) have advised.

Disclosure Statement

No potential conflict of interest was reported by the authors.

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