Customizing Remedial Math for At-Risk, Adult Students

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Introduction

Developmental instruction is designed to improve the academic skills of those underprepared for postsecondary education to a level that will allow them to enroll in college-level coursework (Bailey, Wook Jeong, & Cho, 2009, p. 255). Almost 100% of community colleges offer developmental education at an annual estimated cost of $1.9-2.3 billion dollars (Datray, Saxon, & Martirosyan, 2014, p. 36; Bailey et al., 2009, p. 257). Approximately 60% of community college students are deemed academically unprepared for the rigor of postsecondary education and directed to enroll in developmental education coursework, and this number continues to rise (Daiek, Dixon, & Talbert, 2012, p. 37). Out of the students referred to developmental education, less than one half will actually complete the remedial work and move on to for-credit, college-level courses (Bailey et al., 2009, p. 255).

In recent years, students 25 or older have increased on college campuses and are expected to account for over 40% of the postsecondary student body by 2017 (Tennant, 2014, p. 17). Furthermore, these adult students are often academically under-prepared to a greater extent than their traditional-aged counterparts (Tennant, 2014, p. 17). The synthesis of research on developmental education and underserved, older student populations indicates the need for reform to prevent remedial math from acting as a barrier to adult student graduation (Tennant, 2014, p. 37). Within my project, I explored how developmental math curriculum and supplemental supports can be redesigned at a community college level to better serve students 25 or older who are at-risk of stopping-out prior to completing a credential.

Successful remedial reform initiatives are correlated with increased graduation rates, which in turn, have a significant impact on the lives of at-risk, adult student, higher education institutions, and society at-large (MDRC, 2015, para. 5; Hagedorn, 2015, p. 58). According to the College Board (2013), a nonprofit whose mission is to connect students to college success and opportunity, college graduates are more likely to experience increased earnings, better health, higher employment rates, and possess a
pension than those without a postsecondary credential (pp. 11-32). This nonprofit also outlines the societal benefits of increased graduates, which include heightened tax payments and civic engagement, as well as decreased unemployment and use of public assistance (College Board, 2013, pp. 11-32). Furthermore, scholars calculate that by reducing attrition rates by just 10% even smaller postsecondary institutions would save hundreds of thousands of dollars (Levitz, Noel, & Richter, 1999, p. 32). Lastly, this is a very timely issue for adults in the United States as several social and financial factors have made further education a necessity in order to stay relevant in the job market. Citizens are forced to retire later, and companies often restructure due to the economy. Individuals whose skills have not kept pace with globalization and technology are left in a precarious situation (Cummins, 2015, p.265; Jameson & Fusco, 2014, p. 307). This research shows successful remedial math reform leads to increased graduation rates, which then benefits at-risk students, community colleges, and society at-large.

This project adds to the current academic dialogue taking place around the topic of developmental education in a postsecondary setting, specifically community colleges. Throughout my investigation I compiled, analyzed, and synthesized research from scholars in the disciplines of Education, Community Action, and Business, and the subfields of remedial math, at-risk, adult students, and organizational change. The project concludes with original recommendations regarding developmental math curriculum and supplemental support redesign, as well as a plan to implement the organizational change within a community college setting. My goal is to bring attention to this important issue and provide new insights that may inform the work of community college faculty and administration, especially those focused on supporting under-served, adult student populations.

**Interdisciplinary Approach & Project Methodology**

Within my capstone project, I explored how developmental math curriculum and supplemental supports could potentially be redesigned at a community college level to better serve students 25 or older at-risk of stopping-out prior to completing a credential. My BIS concentration is Higher Education Administration and it is comprised of three disciplines: Education, Community Action, and Business. For
the purpose of my capstone project, I utilized the fields of remedial math (Education), adult learning (Community Action), and organizational change (Business), which align with my three BIS disciplines.

Individuals in remedial math courses are already at-risk of not successfully passing, and therefore, not graduating. Out of the students referred to development education, less than one half will actually complete remedial work and move on to for-credit, college-level courses (Bailey et al., 2009, p. 255). Remedial math professionals are working against the odds in an attempt to quickly jump grade levels of math in order to elevate these students’ skills to a college-ready level. Remedial math is necessary within my project because in the larger discipline of Education there are many subjects, each with their own approach to pedagogy and curriculum dependent on the subject matter, such as science, English, or math. Additionally, the fact that math is remedial adds another level of complexity and an additional difference in pedagogy and curriculum. By conducting a literature review specifically on remedial math, it enabled me to learn about best practices, case studies, curriculum, and various methodologies in that field in order to make curriculum reform recommendations.

Adult learning, a field that falls under Community Action, comes into play as I specifically looked at students that are 25 years or older. The student population I focused on are already at-risk merely because they are enrolled in remedial math courses; however, being an older student puts them into a second category of risk. As my research has shown, adult students are often academically under-prepared to a greater extent than their traditional-aged counterparts (Tenant, 2014, p. 17). Older students also face a number of additional challenges, such as competing outside priorities, low self-confidence, age-related stereotypes, and math anxiety (Jameson & Fusco, 2014, pp. 307-308; Tennant, 2014, pp. 17-18). This is why it is crucial to conduct a second literature review on adult learning and consider this field’s theories and methodologies in order to customize curriculum and supports designed specifically for adult students.

Reform is synonymous with change. After the literature reviews of remedial math and adult learning were synthesized, I crafted original recommendations for curriculum and supplement support
reform. Then I developed a plan for reform implementation based on the field of organizational change, which falls under the discipline of Business. As expressed by Van Wagoner (2004), due to their mission of open access the ability to transform and adapt is critical to the success of community colleges, even more so than other types of higher education institutions (p. 715). Through my literature review on organizational change, I explored the subtopics of: change models, employee perception, subcultures within an organization, crafting messages, and message interpretation. The plan is directed toward community college administration who will lead the implementation. All the staff members under the department of remedial education will be participants in the implementation and the audience for the change message. In order to gain employee support for the reforms, this is a necessary component.

The case for an interdisciplinary approach to my capstone project is really quite simple. If I only explored the question from a remedial math perspective, I would not have considered what other challenges these older, at-risk students might be facing based on their age. Therefore, I would not address age-based concerns in my reform suggestions. Alternatively, if I looked at the project solely from an adult learning perspective, I would have overlooked the pedagogy and curriculum best practices established specifically for the field of remedial math in my recommendations. Lastly, without integrating organizational change, reform recommendations would be presented lacking a plan for implementation within the community college. By integrating the field of organizational change, I took the project one step further toward execution. Although the disciplines each serve a specific purpose within the scope of the project, no one discipline can properly address the issue of remedial math reform targeted at at-risk, adult students.
**Literature Review**

**History and Stigma**

The Association of the Study of Higher Education (ASHE) is an organization exclusively for higher education faculty and administrators that was incorporated in 1976 and produces several publications, including three peer-reviewed journals. ASHE published a report entitled the *History of Learning Assistance in U.S. Postsecondary Education* that outlines learning assistance in higher education beginning in the United States in the 1600s. The first form of learning assistance strictly consisted of tutoring, which was provided to nearly all the postsecondary student body, comprised of only white, affluent males at the time. As almost all students received this form of learning assistance, no negative connotation was attached. However, as time passed, the demographic of college students...
dramatically changed; the shift away from strictly affluent, white males and the inclusion of other groups was apparent beginning in the 1940s through 1970s. During this time period, women, individuals of color, first-generation college students, and individuals of lower socioeconomic status entered the world of higher education, and the student population continues to become more diverse. As inclusion broadened and disparity between demographics grew, only certain groups of students needed learning assistance, and the stigmatization of learning assistance in its various forms began (History of Learning Assistance in U.S. Postsecondary Education).

ASHE reports that over hundreds of years learning assistance evolved from simply tutoring to the broader array of services available today, including developmental education courses and their supplemental supports. In 1874, Harvard was the first higher education institution to offer remedial coursework as part of the college curriculum; prior to that, remedial education took place in advance of college acceptance. By 1913, approximately 80% of colleges and universities provided some type of preparatory programing, and by 1929, almost 50% all postsecondary students were enrolled in remedial coursework, not very different from present day enrollment statistics (History of Learning Assistance in U.S. Postsecondary Education, 2010, p. 33; Parr, 1930, pp. 547-548). In the early 1900s, many four-year institutions shifted responsibility of developmental education to junior colleges, or what is now known as the community college. After community colleges established “open-door” admission policies in the 1960s, they found themselves serving high populations of students in need of learning assistance (History of Learning Assistance in U.S. Postsecondary Education, 2010, p. 39). Since that time, supplemental supports have been developed that vary from school to school, including tutoring and learning assistance centers, academic counseling, mentoring, workshops, peer support groups, online tutorials, and more (History of Learning Assistance in U.S. Postsecondary Education, 2010, p. 24).

Although almost every community college offers developmental education, and the majority of community college students are placed into remedial classes, there is still a stigma attached to learning assistance in the United States. This stigma affects both students referred to these classes and the structure
of developmental education within the community college. As indicated in the ASHE report, when
processes within community colleges developed that would force students into remediation through
placement testing, and no college-level credit was attached to the classes, further stigma developed
toward these students. As higher percentages of these students were low-income and minority, placing
them into remedial classes led to compounded preexisting prejudices (History of Learning Assistance in
U.S. Postsecondary Education, 2010). On an institutional level, as Handel and Williams (2011) state,
developmental education is currently viewed as “a backwater pursuit, unwanted and undervalued by
mainstream faculty” (p. 32). They go on to point out that developmental education’s stigma within
academia is an obstacle to research and reform in the area (Handel & Williams, 2011, p. 32).

**Current Developmental Education Landscape**

Since 2007 the topic of developmental education has been in the spotlight, receiving attention
from both the Obama administration and philanthropists, who have donated millions to improving
remediation through various initiatives (Handel & Williams, 2011, p. 29). However, community college
students have not yet reaped the benefits of these investments, with only “between 33 and 46 percent of
students…referred to developmental education actually comple[ting] their entire developmental
sequence” (Baily et al., 2009, p. 256). Furthermore, public opinion on the matter is split, with some
recognizing the vital social responsibility of both developmental education and its reform, and others
viewing it as “trivializ[ing] the significance of high school, diminish[ing] the meaning of college
admission, [and] erod[ing] the value of a college degree” (Handel & Williams, 2011, p. 29). Additionally,
many point toward the K-12 school system, frustrated that “the state is paying twice to teach skills that
students should have mastered in high school” (Handel & Williams, 2011, p. 29). This type of sentiment
can cause higher education administration and policymakers to blame the K-12 system, viewing
themselves on opposing sides and breaking communication down further (Hamilton, 2013, p. 1016). Lack
of synergy may perpetuate the high need for remediation amongst postsecondary students further due to
division in curriculum and expectations between the two educational levels.
According to NeaToday, a publication of The National Education Association, a professional organization that boosts over 3 million education professionals as members, policymakers in a number of states view developmental education as failing (Flannery, 2014, para. 2). In response, they are actively cutting back resources dedicated to remedial education and requiring fewer students to enroll in remedial coursework. Educators worry that lowering entry standards for college-level coursework and removing remedial education sequences and supplementary supports will erode opportunities for those that need them the most (Flannery, 2014, paras. 14-16). Policymakers are promoting the idea “that somehow [remedial education’s] removal will make less successful students more successful” (Flannery, 2014, para. 2). Remedial educators spoke out during the annual conference of the National Association for Developmental Education (NADE) in 2014, covered by The Chronicle of Higher Education, an online and print periodical geared toward professionals in the field of higher education. Leaders at that meeting urged their membership to publicly “fight back against a national movement to eliminate many remedial courses” (Mangan, 2014, para. 1). The group is upset about reforms and eliminations based on misleading figures from misguided individuals outside of the field of developmental education. Additionally, they say the concept of failure or success is complex and completion rates alone do not tell the whole story (Mangan, 2014, paras. 3-5). NADE leadership encouraged their members to collect their own, more comprehensive data on student outcomes in order to counter the outside input (Mangan, 2014, para. 25).

Considering how long learning assistance has been around and how many individuals are affected by it, there is actually very little research about it. The research that does exist tends to be small-scale, limited, and from individual institutions or survey data, and a common set of metrics has yet to be established (Handel & Williams, 2011, pp. 30-31). However, Handel and Williams (2011) found ten “rigorous” studies after conducting a literature review of Manpower Demonstration Research Corporation (MDRC) content, a nonprofit and nonpartisan education and social policy research organization (p. 30). MDRC’s (2011) research examined four broad types of interventions to developmental education: avoiding, accelerating, contextualizing, and adding supports (p. ES-2). Their findings indicated acceleration and contextual strategies are the most promising, especially courses for college credit with
supplemental supports, modularized or compressed coursework, or contextualizing developmental education with occupational programs (MDRC, 2011, p. ES-2). Additionally, several states have recently completed sizeable studies, suggesting a trend toward growing a more robust body of research (Handel & Williams, 2011, p. 30). Equally problematic is the fact that research findings regarding the effectiveness of developmental education conflict; some demonstrate positive results, some negative, and still others are ambiguous. All these research issues present a problem for developmental education reform, and more formal and large-scale research needs to be funded in order to develop a set of effective best practices (Handel & Williams, 2011, pp. 30 & 31).

**Remedial Math Spotlight**

According to Clyburn (2013), “Developmental mathematics is one of the most serious barriers to educational and economic achievement” (p.16). To earn a postsecondary credential, students are typically required to pass a minimum of one college-level math course; however, an astounding 70% of students referred to remedial math never complete this gatekeeper course (Clyburn, 2013, p. 16). Developmental math typically contains more courses in sequence than developmental English, with public two-year colleges offering an average of 3.6 math classes versus 2.7 reading classes in fall 2000 (Bailey et al., 2009, p. 259). As one might assume, developmental coursework completion rates are negatively related to the number of courses a student is referred to take; the lower in a sequence a student begins, the less likely they will persist (Bailey et al., 2009, p. 259). Given these bleak statistics, many scholars are discussing, studying, and implementing various forms of remedial math reform.

One type of curriculum redesign currently discussed by scholars involves contextual learning, or integrating remedial math into an academic or career technical skills curriculum. This type of curriculum requires team-teaching, a basic education teacher and a content expert. An example would be solving a heat flow problem in a welding class; students are learning math, but not overtly. According to Hamilton (2013), “Contextualized learning enables students to weave the content of academic subjects into the context of their daily lives” (p.1018). Recent brain research supports the concept of contextualized
learning, showing if a student can make a connection between what they are learning and what they already know, it is more likely it will be retained and moved to their long-term memory (Hamilton, 2013, pp. 1018). Conversely, if connections cannot be made, “the brain will actually drop 90% of incoming data as meaningless” (Hamilton, 2013, pp. 1019). According to Jenkins and Kienzl (2009), associated with Columbia University’s Community College Research Center, Washington State’s Integrated Basic Education and Skills Training (IBEST) program is regarded as a best practice model for this type of curriculum with students earning 5 times more college credit and being 15 times more likely to complete workforce training programs (pp 18-23). However, although initially funded by the Washington State Board of Community and Technical Colleges (SBCTC), administrators at the various two-year college launch sites worry whether the program is cost-effective and sustainable (Wachen, Jenkins, & Van Noy, 2011, p. 153).

Another key topic related to developmental math curriculum is the concept of accelerated coursework. Acceleration can take different forms; typically multiple courses are paired into a single semester, allowing students to progress through remedial math in a shorter timeframe. Research indicates that students in accelerated coursework complete at higher rates than those in traditional length courses, and this is constant over varied ages, genders, and ethnicities (Sheldon & Durdella, 2009, pp. 42-43). Postsecondary institutions use acceleration to decrease the time needed to become college-ready and “reduce the number of loss points”, or students stopping-out of school (Venezia & Hughes, 2014, p. 39). Stopping-out is a significant issue in developmental education and community college in general, with students often pulled away from school due to outside life events (Bailey et al., 2010, pp. 256-260; Smith Jaggers, Hodara, Cho, & Xu, 2015, p.5). However, in a study conducted by Cafarella (2014), all 20 community college developmental math professors interviewed warned that acceleration is ideal only for students who have a “solid number sense, good time management and organizational skills, motivation, and dedication…[as well as] previous experience with developmental math content” (p. 55). They go on
to estimate this group makes up less than 20% of the current developmental math student body (Cafarella, 2014, p. 55).

Often used in combination with acceleration is a modular approach to remedial math redesign. According to Bassett and Frost (2010), colleges begin to implement this approach by dividing up remedial math coursework sequences into brief modules or units (p. 870). Modularization can take many forms; entire remedial sequences compiled into one course with many modules, or the same number of remedial math courses broken into modules. The key benefit to this form of curriculum design is the ability for students to work at their own pace instead of a “one size fits all” approach to developmental math (Bassett & Frost, 2010, p. 870). Once students have mastered the curriculum in one unit, they can test-out of the module and move on to the next. Additionally, modularization provides the flexibility to customize levels at which students can leave the remedial math sequence based on educational and career goals. For instance, an individual pursuing a certificate in welding versus a student undertaking an engineering degree could have two different exit points (Bassett & Frost, 2010, pp. 870-871). In spring 2007, Jackson State Community College in Tennessee launched SMART Math, a remedial math redesign using both modularization and acceleration. As a result, remedial math pass, retention, and completion rates all increased, and the program “reduced the institution’s total cost per student by over 20%” (Bassett & Frost, 2010, p. 873).

Regarding supplemental supports, research of online technologies blended with classroom instruction is providing positive results (Bassett & Frost, 2010, p. 871; p. 296; Venezia & Hughes, 2013). A large-scale study that tracked approximately 20,000 students over several semesters at the City University of New York lead to increased course passing rates (Wladis, Offenholley, & George, 2014, p. 1090). The study identified at-risk students and required them to complete online intervention assignments. These assignments provided immediate feedback, which research has shown to be far more beneficial than delayed feedback (Wladis et al., 2014, p. 1085). Beyond the overall significant passing rate improvement, researchers found a strong association between time spent on intervention work and a
student’s grade (Wladis et al., 2014, p. 1090). Another study located at the University of Maryland Eastern Shore integrated an online homework and assessment system into all the university’s remedial math courses. The system included tutorials, an online tutoring center, e-books, quizzes, exercises, diagnostic analysis, and a grade book. Results exhibited lower student withdrawal rates and higher course pass rates (Buzzetto-More & Ukoha, 2009, p. 285). Students in the study self-reported recognizing the value in the system and connecting its use to their success; however, they felt the system was still lacking and needed further improvements (Buzzetto-More & Ukoha, 2009, p. 285).

Peer mentoring, either one-on-one or in a group, in or outside the classroom, has shown promise as a supplemental support for remedial math students. Often times peer mentors are previously successful remedial math students or selected from higher level math courses, and are provided mentor training by the college (George, Khazanov, & McCarthy, 2015, p. 1025; Hooker, 2011, p. 222; Khazanov, 2011, p. 106). One study administered at a Tribal Community College entailed peer mentors inside the remedial math classroom that lead small student groups. Mentors acted as group leaders, guiding students, asking probing questions, and approaching problems from various angles. The completion rate rose from 23% to 43% and the perseverance rate increased from 40% to 47%; comparing students from the previous term prior to the reform to those that participated in the study (Hooker, 2011, pp. 223-224). Another study conducted at the Borough of Manhattan Community College paired at-risk remedial math students with mentors who met with them once a week outside the classroom. Mentors reviewed student homework and assisted them in preparing for tests and quizzes, as well as attempting to bolster their time management and study skills. Students that participated in the peer mentoring intervention benefited from increased retention rates and heightened pass rates; only 30% of un-coached students passed, while 53.8% of coached students did (George et al., 2015, p. 1033).

At-Risk, Adult Learners

Adult education was established as a professional field of practice in the 1920s. Much of the early research on adult education centered on answering the question of whether or not adults were capable of
learning, which resulted in evidence showing “a fairly stable composite measure of intelligence until very old age” (Merriam, 2001, p. 4). Beginning in the 1960s the research focus shifted to how adult learning was different, and this led to “two of the field’s most important theory-building efforts – andragogy and self-directed learning” (Merriam, 2001, p. 4). In 1968, Malcolm Knowles developed the assumptions of andragogy, which he considered to be the art and science of supporting adults in the endeavor of learning (Merriam, 2001, p. 5). Knowles outlined the following six assumptions: requirements should be clearly stated; adults are self-directed and active leaners; experience must be part of the process; individual learning styles need to be considered; curriculum should be applicable; and adults are predominately internally motivated (Rodrigues, 2012, p.30). Around the same time period Tough, building upon the work of Houle, drafted “the first comprehensive description of self-directed learning” as a model for adult learners (Merriam, 2001, p. 8). Self-directed learning can be described as “learning that is widespread, that occurs as part of adults’ everyday life, and that is systematic yet does not depend on an instructor or a classroom” (Merriam, 2001, p. 8). Although adult education has been studied for over 90 years, a consensus does not exist on a single best practice, many theories, models, and principles contribute to the field.

As cited by Tennant (2014), “Students over the age of 25 are one of the fastest-growing demographic groups on college campuses today” (p. 17). However, statistics show older students remain enrolled and graduate at lower rates than traditional-aged college students (Jameson & Fusco, 2014, p. 308). Academic issues that contribute to the low rates of success include less educational preparation in high school, especially in mathematics, and decreased exposure to math during their absence from schooling (Tennant, 2014, p. 18; Jameson & Fusco, 2014, p. 309). Additionally, adult students frequently have lower high school grade point averages, are more likely to have received a nontraditional secondary credential, and often score lower on postsecondary math placement tests than their younger peers (Tennant, 2014, p. 18). This research indicates that older college students tend to be academically underprepared for postsecondary mathematics compared to their traditional-aged counterparts.
Outside of academic preparation, adult college students possess strengths and face challenges that differ from their traditional-aged counterparts. Older postsecondary students tend to demonstrate higher levels of internal motivation regarding their schooling, connecting it to long-term goals, and they often report more satisfaction with their academic experience than younger college students (Jameson & Fusco, 2014, p. 307; Tennant, 2014, p. 18). Additionally, adult students bring life experience to postsecondary education, allowing them to make connections between theory in the classroom and practical applications (Tennant, 2014, p. 18). However, in conjunction with these strengths, older students often experience a myriad of obstacles, including more than 30 hour work weeks, family responsibilities, and financial limitations (Jameson & Fusco, 2014, pp. 307; Tennant, 2014, pp. 17-18). Research also indicates adult students suffer from low self-confidence and feel underprepared when entering postsecondary education (Jameson & Fusco, 2014, p. 308). Furthermore, older students are “subject to age-related stereotype threat regarding their math performance” (Jameson & Fusco, 2014, p. 308). In other words, there is a perception that older students are not as proficient in math as younger students. This stereotype can be internalized by adult students and negatively impact their performance. These obstacles “put adult students at risk for not completing their college degrees” (Tennant, 2014, p. 18).

Based on the compilation of adult learning research, scholars suggest best practices for adult education, including mentors, collaborative group learning, continuous feedback, positive reinforcement, contextual learning elements, experiential components, and self-paced curriculum (Rodrigues, 2012, pp. 31-32). Scholars also call for a change in pedagogy inside the classroom that incorporates “affirm[ing] and validat[ing] adult students’ experiences, highlighting social and academic connection between students, their teachers, and the college in general” (Chaves, 2006, p. 149). Furthermore, older students need to be explicitly shown the differences between practical and academic knowledge, and equipped with the tools and skills necessary to succeed in an academic environment (Kenner & Weinerman, 2011, p. 91). Detailed syllabi that provide a step-by-step description of how the class will proceed, and break larger tasks into smaller, simpler components have been proven successful with adult learners (Kenner &
Weinerman, 2011, p. 92). Lastly, some in academia are researching the use of technology in the form of tutorials and simulated activities as a supplement to teacher-directed instruction for at-risk adults enrolled in developmental math courses (Li & Edmonds, 2005, p. 143). The potential benefits of incorporating such technology include instantaneous feedback, unlimited review of the materials, a customized learning pace, and capability for students to utilize assistive technology devices (Li & Edmonds, 2005, pp. 144-145).

**Organizational Change: The Community College**

A study that included 43,426 organizational change efforts in a variety of industries revealed that only 33% of the initiatives were successful (Smith, 2002, p. 27). Organizations today are faced with change due to globalization, technology, market forces, and diminished resources, coupled with an increasing amount of stakeholders (Locke & Guglielmino, 2006, p. 108; Matheny & Conrad, 2012, p. 111). Community colleges encounter additional factors: government mandates, evolving demographics, enrollment pressures, declining state funding, fundraising pressure, and an increase in academically underprepared students (Malm, 2008, p. 616). Due to their mission of open access, the ability to transform and adapt is critical to the success of community colleges, even more so than other types of higher education institutions (Van Wagoner, 2004, p. 715). Community colleges are tasked with continually reinventing curriculum, programs, and services based on ever-changing societal needs, and environmental challenges and uncertainties are driving these institutions to “the cusp of transition” (Malm, 2008, p. 615).

An important topic in organizational change is employee perception; if the perception is negative, it can breed conflict and stifle change. Van Wagoner (2010) conducted a survey of 510 professional staff members of 12 community colleges in Colorado to analyze the institutional and individual characteristics that influence perception of organizational change (p. 715). The study explored change source, extent, process, and value through the domains of decision-making, programs, support services, and resources (Van Wagoner, 2010, pp. 717-718). A few key results were produced from the study that can be leveraged by community college leadership looking to innovate. Firstly, when individuals have a strategic
understanding of the college and can connect change to the institution’s mission, they are more likely to accept it. Secondly, the more colleges include employees in the change process, the better the chance that those employees will understand and support the change. Lastly, community colleges must clearly articulate the value added by the changes for both the organization and the employees as individuals (Van Wagoner, 2010, pp. 724-725).

To complicate matters further, beyond straightforward organizational culture, community colleges are comprised of various subcultures. Locke and Guglielmino (2006) conducted a qualitative exploratory case study involving 86 community college employees broken into the subcultures of administration, senior faculty, junior faculty, and support staff (pp. 110-112). The results showed that each subculture experienced, reacted to, and were impacted by change uniquely. Administrators were focused on collaboration and leadership development in the process, as well as expanding programs and services. The senior faculty’s concerns related to the classroom, student achievement, and academic freedom, while the junior faculty viewed change as natural and necessary for survival and success of the college. Support staff were primarily student-service orientated and wanted to be more empowered in their ability to assist students (Locke & Guglielmino, 2006, pp. 117-118). Locke and Guglielmino (2006) conclude the study with several recommendations for community college leadership to follow when implementing change, including: know and understand subcultures, factor subculture differences into change plans, recognize the ability of subcultures to facilitate or hinder change, allow time and patience for change to occur, and finally, integrate subculture differences for college-wide change (pp. 120-124).

Another vital component of organizational change involves crafting a message around the change and predicting how that message will be interpreted. Sensemaking is the process by which individuals interpret change and then adjust their thinking and understanding about the change accordingly; while framing utilizes or emphasizes one set of meaning(s) over another in relaying information (Eddy, 2003, pp. 453-454). Scholarly research recognizes four venues for communicating change on community college campuses, including: “walking the frame, talking the frame, writing the frame, and symbolizing
the frame” (Eddy, 2003, p. 453). A multiple case study of two community colleges, comprised of interviewing 28 employees at various levels and reviewing artifacts, such as speeches, marketing campaign items, campus newsletters, and planning documents, revealed campus members interpret change differently based on how leadership frames it (Eddy, 2003, p. 469). This serves as a lesson to leaders that “awareness of and reflection on their preferred frame can spotlight their leadership blind spots and allow for adjustments” and “framing tools allow [leadership]…to actively construct the reality for the campus corresponding with the vision and mission” (Eddy, 2003, p. 469). Furthermore, campus leaders should deploy the message through all four communication venues as individuals have varied preferences (Eddy, 2003, p. 469).

Carter (1998) recommends five strategies for beginning organizational change, including engaging the entire college and raising awareness, stabilizing touchstones, increasing intra-college linkages, providing opportunities for innovation, and designating resources and support (pp. 435 & 441). She goes on to suggest specific activities and tactics that correlate with each strategy in a community college setting. Suggestions that fall under engaging the college community and raising awareness are guest speakers, structured discussion, college-wide forums, and constant and consistent communication. Stabilizing touchstone tactics consist of articulating core values, internal focus groups, revisiting mission and vision, and establishing short-term goals. Cross-functional teams and an open-book approach to management are recommended for increasing intra-college linkages. In order to create opportunities for innovation, Carter (1998) advises incentives, systems review and design, creating temporary systems, and experimentation with enterprise units (p.442). Finally, appropriate resources and support activities include on-going training, linked professional development plan, funded experimentation, and appropriate transition budget (Carter, 1998, p. 442). “A solid and well-thought-through framework for the college’s transformation and a systematic and integrated set of tactics or activities designed to support the process” are most essential in successful organizational change (Carter, 1998, p. 449).
Methods

In order to answer my research question, I performed scholarly literature reviews on the fields of both developmental math and adult learning. Afterwards, I compared, contrasted, and synthesized the findings to form original suggestions for best practices that can be utilized by higher education professionals to remove remedial math as a barrier to graduation for at-risk, adult students. Finally, I conducted a third literature review on the field of organization change to formulate a change plan for community college administrators that will increase the likelihood of reform success. The analysis performed was qualitative and consisted of document review of primarily secondary sources. All sources were either peer-reviewed journal articles, scholarly books, or reports and articles from professional higher education organizations. Well over one hundred articles were read and helped shape the direction of my project. However, only 58 articles directly informed this paper with 93% published in 2000 or more recently to ensure timeliness of content. The few older texts that are cited are primarily the original works of past leading education scholars.

Analysis and Recommendations

After comparing and contrasting the literature reviews of developmental math and adult learning, I concluded that remedial math must be reformed in order to better serve at-risk, adult students. As discussed in the literature review, remedial math within community colleges is failing with only 30% of students referred to developmental math coursework moving on to complete a college-level math course (Clyburn, 2013, p. 16). Older students are graduating at lower rates than their traditional-aged counterparts, putting them further at-risk (Jameson & Fusco, 2014, p. 308). Research also indicates that the population of students 25 and older has grown on college campuses and is expected to reach 40% of the student body by 2017 (Tennant, 2014, p. 17). Additionally, according to the National Student Clearinghouse (2014), research on students that entered college in 2008 indicates that only 39% of students who began at community colleges graduated within a six year period (p. 31). The compilation of
this research leads me to believe if reform does not take place, completion rates of community college students will decrease even further from this already dismal percentage.

Comparing and contrasting current practices and theories in the fields of both remedial math and adult learning lead me to suggest a self-paced curriculum with contextual learning components and online supportive technologies, as well as peer mentoring as my reform recommendation. Regarding self-paced learning, it has proven to be effective in remedial math by way of a modular approach, which allows students to move through material more quickly or slowly based on their individual level (Bassett & Frost, 2010, p. 870). Adult learning scholars also suggest self-paced learning as a viable strategy for older students as they generally prefer to be self-directed and are intrinsically motivated (Jameson & Fusco, 2014, p. 307; Rodrigues, 2012, pp. 30-32). Results have demonstrated contextual learning allows remedial math students to connect academic learning to their daily lives, and therefore, retain what they have learned longer (Hamilton, 2013, p. 1018). According to Knowles’ Theory of Andragogy, adult learners are more driven to learn if they perceive the content will be immediately applicable to their lives (Rodrigues, 2012, p. 30). Contextual learning allows this perception to occur by designing curriculum around work place and home life activities.

In addition to self-paced curriculum with contextual learning components, online supportive technologies and peer mentoring as supplemental supports have proven to be beneficial for both older learners and remedial math students. Studies verify online technologies improve student outcomes in remedial math courses (Gallard et al., 2010, p. 11; Taylor, 2008, p. 48-49; Wladis et al., 2014, p. 1090). These technologies allow for instantaneous feedback, unlimited review, and the use of assistive technology devices in a non-threatening environment, which have been shown to enhance the performance of adult students as well (Li & Edmonds, 2005, pp. 144-145). Peer mentoring, either one-on-one or as a group, has proven to be effective within remedial math courses (George et al., 2015, p. 1036; Khazanov, 2011, pp. 116-118; Hooker, 2011, p. 225). Furthermore, adult learning scholars and professionals promote mentoring for older student success. They make connections between mentoring and boosting

The chart below lists the various learning components and supplemental supports researched within this project. If an “X” is located under either the field of remedial math or adult learning, that particular component or support proved to be successful within that field. Components and supports that were successful in both fields were included in my recommendations.

<table>
<thead>
<tr>
<th>Learning Components &amp; Supplemental Supports</th>
<th>Successful Remedial Math</th>
<th>Successful Adult Learning</th>
<th>Mixed Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contextual Learning</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Accelerated Learning</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Self-Paced Learning</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Online Tutorials</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Peer Mentoring</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>College Success Skills</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Figure 2 Comparing Learning Components & Supplemental Supports

As previously noted, debate exists within the American public and government as to whether resources should be allocated toward postsecondary remedial education. Some take the stance that our society is based on competition and everyone does not have the skillset for higher learning, others simply feel the system is broken, so why continue to fund it. However, research demonstrates if remedial education is either eliminated or diminished, it will have a severely negative impact on community colleges’ ability to fulfill their mission of successfully serving students from all demographics of our nation. As Phelan (2014) said, “Democracy’s College stands in peril; its promise and hope for the masses are at risk” (p. 8). Although there is no doubt the system is broken at the moment, if we wish to attain
greater equity in this nation, we must strive to improve it, instead of admitting defeat. In the words of famed educational reformer Horace Mann, “education…is the great equalizer of the conditions of men” (Massachusetts State Board of Education, 1848, para. 9). As a nation, this should be the ideal we embrace and aim to achieve.

Secondly, I conclude that an organizational change plan must be crafted and implemented in order to increase the likelihood of reform success. As mentioned earlier, a large-scale scholarly study revealed that only 33% of organizational change efforts attempted in a diverse array of industries were successful (Smith, 2002, p. 27). Within higher education, a variety of factors including financial strain, technology expansion, changing faculty roles, public scrutiny, evolving demographics, and global competition make change imperative (Kezar & Eckel, 2002, p. 295). Due to their mission of open access, the ability to transform and adapt is even more critical to the success of community colleges (Van Wagnor, 2004, p. 715). A survey of 210 managers from a cross-section of industries in North America showed change implementation success was strongly correlated with “visible support by the sponsor, employees knowing what they had to do to support the change, and adequate resources” (Smith, 2002, p. 75). Research indicates consideration of subcultures, employee inclusion, understanding value and connection to the mission, and approach to framing and distributing the change message have a significant effect on reform within a community college setting (Eddy, 2010, pp. 469-470; Locke & Guglielmino, 2006, p. 125; Van Wagoner, 2010, pp. 724-725).

My recommendation is a plan that will be implemented by the Developmental Studies department and disseminated college-wide. Beyond increasing likelihood of reform success, the purpose of the plan is to improve the experience of at-risk, adult students inside the remedial math classroom and at the college as a whole by gaining employee support and awareness. The plan should demonstrate sponsor commitment, cater to employee perception and inclusion while taking subgroups into account, tie change to the college’s vision, and educate staff regarding their role in the reform. Specific tactics suggested by higher education scholars for accomplishing this, include department or division level discussions,
college-wide forums, internal focus groups, transition team monitoring, incentives, training and professional development, guest speakers, and constant communication (Carter, 1998, p. 442). Additionally, framing and distribution of the change message play a vital role in reform and must be addressed in the implementation plan. The change message can be distributed by talking the frame, walking the frame, writing the frame, and symbolizing the frame (Eddy, 2003, p. 466). Talking the frame includes open forums and small group conversations; while walking the frame refers to physically taking the message to various campus members. Writing the frame involves spreading the message through memos, web postings, and emails promoting change related events. Lastly, symbolizing the frame uses literal or metaphoric symbols to aid in conveying the change message (Eddy, 2003, p. 466).

**Limitations**

The first limitation of this paper is the fact that at this point the recommendation is a theory, as it has not yet been put into practice. Obviously, this theory is grounded in credible and relatively extensive interdisciplinary research; however, the case for my particular recommendations would be made much stronger if a case study were conducted. Therefore, I propose a case study be included in suggestions for future research. This case study would consist of implementing the recommendations outlined within this paper and tracking the success of students in the reform group versus student outcomes for a control group enrolled in a standard remedial math course.

Another limitation of my work is the fact that funding was not considered within the scope of this paper. In recent years, government funding of community colleges decreased, which has forced further reliance on tuition and fees. However, simultaneously student financial aid remains stagnant and community colleges face increased pressure to successfully serve more students at a lower cost (Phelan, 2014, p. 6). Various factors play into the financial crisis within community colleges including declines in enrollment and related decrease in revenue, reduction in state aid, unsustainable initiatives, unfunded mandates, and rising expenses (Phelan, 2014, p. 8). Although my recommendations are directly tied to the open access mission of community colleges, the financial crisis increases the difficulty of securing funds
for reform or new initiatives. Additionally, many changes within community colleges are initially grant funded; however, grant funding is not intended to be permanent, risking the sustainability of reform (Clyburn, 2013, p. 16; Handel & Williams, 2011, p. 29; Phelan, 2014, pp. 13-14; Romano, 2011, p.973; Wachen et al., 2011, p. 153).

**Future Research**

In addition to conducting a case study designed around the recommendations within this paper, other suggestions for future research include an adult college success skills course, workshops geared toward older students, and community resource support. Upon enrolling at a community college, students typically are required to take a college success skills course, which covers topics such as study skills, learning styles, communication skills, and time and stress management (Northern Virginia Community College, 2010, para. 4). I suggest research that examines whether a college success skills course, specifically tailored for adult learners as a prerequisite to enrolling in remedial math, would have a positive impact on completion rates for older students in developmental math courses. This college success skills course would blend adult learning principles with its already established curriculum and learning outcomes, adding topics like, practical versus academic knowledge, community resources, technology training, school-life balance, self-confidence, and career planning. Adult learning research demonstrates these topics, or lack of knowledge about them, can act as a barrier to the success of older students; therefore, awareness prior to enrolling in remedial math may increase completion rates.

Besides an adult college success skills course, research should be conducted regarding the effect of math anxiety workshops designed for at-risk, adult learners. A study conducted by Jameson and Fusco (2014) showed that “adult learners self-report lower levels of math self-efficacy and higher levels of math anxiety than their traditional peers” (p. 306). Workshops that provide tips and resources for overcoming math anxiety and boosting math self-efficacy may have a positive impact on the remedial math success rates of older students. It would be interesting to perform a case study that compared two groups of at-risk, adult students taking a remedial math course; one group would attend math anxiety workshops in
addition to classes and the other would not. This would allow a comparison between the two groups to see whether the group that attended the workshops had a higher course completion rate.

Lastly, I propose future research related to student success and connecting adult students with community resources. As mentioned early, older students face many challenges that typically do not affect their traditional-aged counterparts (Jameson & Fusco, 2014, p. 307; Tennant, 2014, pp. 17-18). Low-income, adult students are particularly at-risk of early withdrawal prior to credential completion (Fairchild, 2003, pp. 12-13; Milheim & Bichsel, 2007, pp. 39-40). Scholars suggest either a college maintained webpage or a physical resource center that refers students to community resources in order to support their ability to persist and graduate (Veney et al., 2012, p. 3). This would include resources such as affordable childcare, county crisis services, nonprofits that provide basic needs, and so forth. Future research could track the academics of students utilizing this resource to determine its impact on their success.

Conclusion

Developmental math at a community college level is failing. Older students placed into remedial math courses face double jeopardy as they are already at a higher risk than their traditional-aged counterparts of dropping out. While some in government and society feel the solution is to diminish or discontinue remediation in postsecondary education, I argue without it, the community college’s mission of serving all segments of the population will be in greater peril. Instead, as postsecondary educators we should strive to make education the great equalizer in our society; therefore, I recommend reforming remedial math to better serve at-risk, adult students. As change initiatives across industries are often ineffective, I further recommend drafting and implementing a research-based organizational change plan related to the reform in order to increase the likelihood of its success. My hope is that higher education professionals will be able to take my theory and attempt it in practice, advancing research in this area through a case study. Evidence demonstrates successful remedial math reform has led to increased graduation rates, which in turn betters the lives of at-risk students, fulfills community college objectives,
and uplifts society at-large. Although the task may seem daunting, we cannot turn our backs on those who are at-risk; the community college is their last educational hope, and we must rise to meet our responsibility!
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