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Exploring the Impact of Noncognitive Factors in Developmental Mathematics: Nontraditional Student Voice

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Abstract

Using a transcendental phenomenological approach, this study explored what and how noncognitive characteristics impacted the learning experiences of students enrolled in three different modalities of a developmental mathematics course at a postsecondary technical college in a mid-sized city in the northern plains. Data were collected through individual, semi-structured interviews. Across all instructional modalities, the emergent themes were growth and career advancement, learning preferences, strategies for success, application of knowledge, and support network. Findings indicated similarities between instructional modalities regarding long term career goals, multiple approaches to learning, and the connection between modality selection and preferred course structure. There were also differences between instructional modalities regarding course goals, strategies for minimizing distractions, and the role or lack thereof of the learning community in the developmental mathematics course. Implications for practice were discussed and recommendations for future research were made.

Keywords**:** student perceptions, noncognitive characteristics, instructional modalities, nontraditional students, higher education, developmental education

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Introduction

A shortage of skilled workers, the rising cost of higher education, and the increase in student debt has led to an emphasis on developmental education policy and reform in American higher education (Boylan et al., 2017). This emphasis has resulted in legislative mandates regarding developmental education in numerous states. From a recent review of literature and official reports, it was determined that 42 states had policies regarding some aspect of developmental education, 38 states had policies related to assessment, 37 states had statewide or system wide policies regarding developmental education placement, and 32 states had policies that address or mandate developmental education instructional reforms (Hodges et al., 2020).

The National Association for Developmental Education (2010), now renamed the National Organization for Student Success, articulated that the goals of developmental education are to create opportunities for all postsecondary learners to learn and succeed, to support the development of skills and attitudes that assist in the realization of academic and career goals, and to increase student retention and completion rates. Despite this comprehensive intent of developmental education, one component—the redesign of coursework—has become the specific issue at the forefront of policy and reform as stakeholders emphasize retention and completion statistics (Complete College America, 2012; Mangan, 2019). This legislative focus has led institutions to consider alternative instructional modalities, acceleration and contextualization models, and placement practices as they seek to fulfill mandates, answer to stakeholders, and meet the needs of their students. The challenge is to identify the combinations of instructional modalities and models that best meet the needs of specific students at specific institutions. The impact of noncognitive characteristics on the learning experience must be taken into consideration when addressing this challenge.

Success in developmental education is often determined by retention, persistence, and completion metrics and data (Bailey et al., 2010). However, to best support students, a student success perspective is imperative as this perspective focuses on helping students meet their personal educational goals (Renn & Reason, 2013). In developmental education, a student success perspective draws on the noncognitive characteristics of students that are impacted by student development and involvement (Astin, 1993), academic and social integration (Tinto, 1991), and perseverance and passion for long-term goals (Duckworth et al., 2007). Additional research is necessary to explore what characteristics, particularly what noncognitive characteristics, impact student success in a particular instructional modality so that institutions may make informed decisions about which interventions and opportunities to offer. It is also imperative for institutions to identify efficient models by which students can proactively be identified for placement in an instructional modality or acceleration model. The identification and development of these placement models must include an understanding of how noncognitive characteristics impact student success. One way that institutions, scholars, and policy makers have addressed the challenge of simultaneously providing access and pathways is by implementing a multiple measures placement approach. Although this approach is widely implemented with at least 18 states requiring a multiple measures approach, the implementation is not uniform, and it does not require the inclusion of a specific set of variables (Hodges et al., 2020). Most notable is the frequent absence of noncognitive measures.

In a survey conducted by the National Center for Developmental Education regarding developmental education programs at community colleges, only 7% of responding institutions

used noncognitive measures to inform the placement process (Gerlaugh et al., 2007). Despite the repeated calls to use multiple measures that include noncognitive characteristics, aside from the Multiple Measures Assessment Project at 10 Minnesota and Wisconsin colleges (Cullinan et al., 2018), there is no evidence that the use of noncognitive measures for placement has increased. Thus, research is limited regarding the efficacy of including noncognitive measures in the placement process. The absence of noncognitive measures in the course placement process can potentially be attributed to lack of efficacy research (Ngo & Kwon, 2015) and the perception that noncognitive measures are less accurate or valid than cognitive measures (Melguizo et al., 2014).

Given the lack of literature available that addresses the interaction between noncognitive characteristics, learning environments, and instructional modalities, the purpose of this study was to explore how noncognitive characteristics and instructional modalities affect a student's perception of the learning experience. It is impossible to consider all conceivable noncognitive variables; however, it is important to explore the connections between noncognitive characteristics and the learning experience based on instructional modality with the intent that this research will be used to inform course modality selection and placement decisions by both advisors and students. This study was guided by the following two research questions: (1) What are nontraditional students' perceptions of the effects of noncognitive characteristics on their developmental mathematics learning experience? and (2) What are the similarities and differences in nontraditional students' perceptions of the effects of noncognitive characteristics on their developmental mathematics learning experience based on the instructional modality?

Review of Literature

This review of literature provides an overview of the research that informed the development of this study. It focuses on an examination of the noncognitive and demographic characteristics that are exhibited by students in developmental education programs. The review further presents literature that considered cognitive, noncognitive, or affective characteristics in connection to a particular instructional modality or redesign model as well as literature related to developmental education course placement and the inclusion of noncognitive characteristics.

Noncognitive Characteristics

Noncognitive characteristics are variables that relate to adjustment, motivation, and student perceptions (Sedlacek, 2004). There have been repeated calls to include noncognitive measures such as self-concept, self-appraisal, navigation of the system and racism, goal-setting, an available support person, leadership experience, community involvement, and acquired knowledge in the placement process (e.g., Boylan, 2009; Boylan & Saxon, 2012; Saxon & Morante, 2015; Sedlacek, 2004). These calls for inclusion illuminate the challenges of assessing noncognitive variables. Challenges such as determining which noncognitive variables to focus on, identifying the most appropriate method or tool to use, and training personnel to minimize the subjectivity of the assessment are imperative to consider prior to implementation.

Noncognitive Characteristics and Nontraditional Students

It is evident that the literature recognized the diversity of the student population with respect to demographic and noncognitive characteristics. A significant portion of the literature

regarding instructional modalities and acceleration models focused on demographic characteristics, such as gender, age, ethnicity, and enrollment status, and the relationship between those characteristics and course pass rates (e.g., Bailey et al., 2010; Fong, Melguizo et al., 2015). However, there was also an effort to address how noncognitive characteristics, such as self-efficacy, self-regulation, and sense of belonging, impact student success (e.g., Fong, Zientek et al., 2015; Guy et al., 2015; Zientek et al., 2017).

Noncognitive characteristics, particularly a sense of belonging and the availability of a strong support person, are important for nontraditional students. Adult learners feel less connected to the college than their traditional-aged counterparts (Rabourn et al., 2018). Strayhorn (2016) identified core elements of belonging that include the malleability of belonging given specific times, contexts, and populations as well as the impact of social identities. In a study on supporting belongingness in community college classrooms, Gilken and Johnson (2019) emphasized the active role of the student in cultivating a sense of belonging and identified motivation, persistence, and academic performance as outcomes of a sense of belonging.

In an attempt to understand the academic experiences of nontraditional students, Chen (2015) interviewed five nontraditional students regarding the availability and utilization of support systems and programs, the overall experience at the college, and the knowledge gained from the academic experience. The students identified commitment, motivation, and support as critical components of their experience and success. An available support person is particularly valuable in times of crisis (Sedlacek, 2004).

Student Characteristics and Instructional Modalities

Institutions are developing and implementing a variety of innovative instructional modalities. Several studies focused on course success in the redesign model compared to the traditional format (e.g., Kinney et al., 2004; Spradlin & Ackerman, 2010). Researchers who compared academic performance in traditional lecture modalities versus computer-mediated modalities noted that students learned equally well in both formats (Spradlin & Ackerman, 2010; Zhu & Polianskaia, 2007). However, the literature recommended an improved course selection process that incorporates learning style. In the literature that focused on online, hybrid, and self-paced courses, it was noted that academic experience (Cochran et al., 2014; Wang et al., 2013), self-discipline (Kauffman, 2015), and self-motivation (Beamer, 2020; Boatman & Kramer, 2019) were characteristics that impacted persistence and course success. There is limited research that analyzed data in a way that determined course success by noncognitive characteristics.

Student Characteristics and Placement Practices

Placement for reading, English, and mathematics courses is at the forefront of higher education discussions (e.g., Belfield & Crosta, 2012; Hughes & Scott-Clayton, 2011; Saxon & Morante, 2015). Nationally, approximately 68% of public community college students and 40% of public 4-year college and university students are referred to developmental education coursework each year (Chen, 2016). Scott-Clayton (2012) challenged the efficacy of placement exams as the sole placement measure as she estimated that 18% of students who were placed in developmental mathematics would have earned a B or higher in a college-level mathematics course without the prerequisite developmental course. It is important to examine placement

policies as initial placement has a significant impact on pathways, opportunities, and outcomes of students (Ngo & Melguizo, 2016).

Institutions acknowledge that a single course placement tool limits the accuracy of mathematics course placement. There is evidence that a multiple measures approach that includes a noncognitive characteristic component can increase placement accuracy and access to education (Ngo et al., 2018; Ngo & Kwon, 2015). Researchers have suggested models and tools for which to assess noncognitive characteristics and supplement the traditional cognitive placement measures (Boylan & Saxon, 2012; Sedlacek, 2004). Additional research is necessary to identify efficient models that incorporate noncognitive characteristics by which students can be proactively identified for placement in a particular instructional modality or acceleration model.

Conceptual Framework

The conceptual framework for this study was grounded in three assumptions that emerged from research literature. The first assumption was that noncognitive characteristics impact the learning experience. Sedlacek (2017) emphasized the role of self-concept, self-appraisal, navigation of the system and racism, goal-setting, an available support person, leadership experience, community involvement, and acquired knowledge in the placement process on the learning experience. The second assumption was that human functioning is influenced by personal, behavioral, and environmental factors. Bandura's social cognitive theory emphasizes the independent yet interdependent roles of these factors on human functioning (Bandura, 1986). As applied to this study, it was expected that forethought, performance, and self-reflection influence the learning experience because this model identifies the connections between person, environment, and behavior. The third assumption was that intelligence can be demonstrated analytically, creatively, and practically. Sternberg (1999) defined intelligence as "the ability to achieve success in life, given one's personal standards, within one's sociocultural context" (p. 293). Whereas most intelligence measures focus on the analytical component, Sternberg (1997) also included creative and practical components in his triarchic theory of successful intelligence. The inclusion of multiple forms of intelligence in the admissions and placement process is necessary for increasing inclusion and access for underrepresented and diverse populations.

Method

This was a qualitative, transcendental phenomenological study. As defined by Moustakas (1994), the intent of phenomenological research is to describe the essence of both what the participants experienced as well as their perceptions of the experience. This approach allowed for an in-depth inquiry of several participants who shared a common experience. Specifically, we explored students' perceptions of the effects of noncognitive characteristics on their developmental mathematics learning experience. We also examined the similarities and differences in students' perceptions of the effects of noncognitive characteristics on their developmental mathematics learning experience based on the instructional modality.

Setting and Participants

This study was conducted at a postsecondary technical college in a mid-sized city in the northern plains. The college offers applied associates of science (AAS) degrees, diplomas, and certificates in approximately 60 program areas that focus on preparing students for trades and industry with an approximate annual enrollment of 2,400 students. Students pursuing AAS degrees and diplomas are required to take a mathematics course. The college employs mandatory placement practices for mathematics courses. If a student has an ACT math sub-score less than 19 or a NextGen Accuplacer Arithmetic score less than 99, then the student is required to take Math 100, which is an entry-level developmental mathematics course. This course is offered in a traditional 16-week face-to-face format, a 16-week online format, a 16-week hybrid format, and a 10-week accelerated online format. The college does not employ noncognitive measures for college entrance or course placement.

Participants for this study were selected through a criterion-based purposive sampling scheme (Creswell & Poth, 2018). All students who enrolled in the Math 100 course between Fall 2019 and Spring 2021 were sent an email invitation to participate in the study. The initial population included approximately 1000 students from 50 sections and five instructors over five terms. Students were asked to self-identify which of the seven possible characteristics that the National Center for Education Statistics (1996) uses to determine nontraditional status they possessed. Those characteristics include delayed enrollment into postsecondary education, part-time enrollment status, financial independence, full-time work status, having dependents, being a single parent, and not obtaining a standard high school diploma. From those who volunteered to participate, four nontraditional participants from each of the three 16-week instructional modalities (traditional, online, hybrid) were selected. To prevent bias, students from the 10-week accelerated online format were not selected for this study as one of the researchers was the only instructor for this modality during the time period for this study.

At the beginning of each interview, all 12 participants were asked to provide background information about themselves including their program of study, career aspirations, and the characteristics that classified them as nontraditional students. Nine participants were female, and three participants were male. Two of the 12 participants, or approximately 17%, were non-white, which is consistent with the population of the research site. Students ranged in age from 20 years to 48 years. The most prominent nontraditional characteristic was delayed college enrollment (11/12) followed by financial independence (10/12), full-time employment (7/12), responsibility for dependents (5/12), single parent status (3/12), part-time enrollment (2/12), and attainment of a non-standard high school diploma (2/12). Table 1 displays the demographic information.

Table 1

Demographic Information of Participants

Participant	Modality	Age	Gender	Nontraditional Student Characteristics
Participant 1	Traditional	36	Female	Delayed college enrollment, financially independent, had dependents, worked full-time

(continued)

Participant	Modality	Age	Gender	Nontraditional Student Characteristics
Participant 2	Traditional	23	Female	Delayed college enrollment, enrolled part-time, financially independent, worked full-time
Participant 3	Traditional	48	Male	Delayed college enrollment, enrolled part-time, financially independent, worked full-time
Participant 4	Traditional	27	Female	Delayed college enrollment, financially independent, had dependents, single parent
Participant 5	Hybrid	22	Female	Delayed college enrollment, worked full-time
Participant 6	Hybrid	24	Female	Delayed college enrollment, financially independent, had dependents, single parent
Participant 7	Hybrid	20	Female	Financially independent, worked full-time
Participant 8	Hybrid	20	Female	Delayed college enrollment, worked full-time
Participant 9	Online	29	Female	Delayed college enrollment, financially independent, non-standard high school diploma

(continued)

Participant	Modality	Age	Gender	Nontraditional Student Characteristics
Participant 10	Online	37	Male	Delayed college enrollment, financially independent, had dependents, worked full-time
Participant 11	Online	26	Female	Delayed college enrollment, financially independent, had dependents, single parent, non-standard high school diploma
Participant 12	Online	20	Male	Delayed college enrollment, financially independent

Instrument and Data Collection

Consistent with the phenomenological approach of collecting evidence through first-person reports of life experiences (Moustakas, 1994), the data for this study were collected through interviews. The 12-question interview protocol (see Appendix A) was developed by the researchers using Sedlacek's (2004) Noncognitive Questionnaire (NCQ) as a guide. It was piloted in interviews with two students who met the criteria, and those responses were not used in the final data analysis.

A total of 12 students were interviewed. Each of the individual interviews with the participants was approximately one hour in length for a total of 709 minutes of interview data. Seven interviews were conducted face-to-face and five interviews were conducted virtually. The semi-structured, open-ended interview protocol allowed the participants to elaborate upon their responses (Salkind, 2012), and additional follow up questions were asked as needed.

Data Analysis

Interviews were transcribed and field notes were converted to electronic files, which were then sent to participants for the member checking process. Following member checking, a preliminary read-through of the data was examined for general themes. Initial reactions and reflections were noted in the reflexive journal. Segments of text were bracketed and labeled as significant statements, sentences, and quotes that provide an understanding of how the participants experienced learning were highlighted (Creswell & Poth, 2018). First cycle codes were determined using In Vivo Coding, which keeps the exact words of the participants (Saldaña, 2016).

Pattern coding was used during the second cycle of coding to group the first cycle codes into fewer themes. The explanatory and inferential pattern codes identified the emergent themes (Saldaña, 2016). The structural and textural descriptions determined through the first and second cycle codes provided the foundation for the composite description that resulted from the interpretation of the data. The composite description informed what and how noncognitive characteristics impacted the learning experience in different instructional modalities of developmental courses.

Findings

The purpose of this study was to explore how noncognitive characteristics impacted the learning experiences of students in a developmental mathematics course. Participants were asked to discuss their strengths and areas of improvement related to learning, to describe how they handled adversity during the course, to identify their career and course goals, and to share how they use mathematics outside of the formal learning environment. Table 2 displays the emergent themes and relevant codes that emerged from data.

Table 2

Noncognitive Characteristics and Learning Preferences: Emergent Themes and Relevant Codes

Theme	Relevant Codes
Growth and career advancement	Goal Setting; Leadership; Self-improvement; Depth of learning; Desire to learn; Future goals; Personal fulfillment; Further education; Workforce advancement
Learning preferences	Class structure; Immediate feedback; Learning environment; Participation expectations; Hands-on experiences; Independent learner; Self-paced; Visual learner; Multiple approaches; Learning styles; Modality selection
Strategies for success	Time management; Note taking; Distractions; Attention span, Online learning platform; Test-taking skills; Organization; Pace of course; Improving focus
Application of knowledge	Contextualized content; Purpose of concepts; Confidence development; Application in the field
Support network	Learning community; Interaction with classmates; Interaction with instructor; Access to tutor; Course navigation; Friends and family

Growth and Career Advancement

The *Growth and Career Advancement* theme highlighted key motivating factors for the participants. All participants in the study articulated career goals that centered around their program of study. They shared both short-term goals, such as gaining experience in their career field, as well as long-term goals including self-employment, additional education, and opportunities to use their skills creatively. Advancement in the workforce and personal fulfillment were cited as sources of motivation for the stated career goals.

Self-improvement was a common code with participants who were looking to advance in the workforce and to pursue a new career. Participant 10 stated, "[I] realized I need to quit messing around and change something to make myself more appealing…my current skillset wasn't quite enough." He debated between two programs and ultimately chose computer programming because it would "give me more of a challenge." Participant 1 stated she is "in the business of reinventing herself right now" and discussed the reason she decided to pursue a degree after more than 20 years in the restaurant industry:

> I am sick of working nights and weekends and missing everything with my friends and family, and [so I] decided that I wanted to do something different, but I didn't really know how. And so my aunt suggested that I go to school to get some sort of degree to compliment my years of experience, and she actually is the one who found the […] marketing program. And kind of, it's something that you could really do anything with a marketing degree.

Whereas the goal of Participant 10 was to "put a little bit of shine on [his] resume and try to move up" at his current company and the goal of Participant 1 was to train for a new career, both are motivated by the desire to improve themselves.

Participants identified specific characteristics they desire in a career in order to be personally fulfilled. Participant 1 was interested in possibly working for a non-profit organization, but ultimately she was determined to find a "holistic, ethical, wonderful work environment." Participant 5 wanted to become a traveling surgical technician once she fulfilled the expectations of her scholarship to work in the state for three years. She wanted to simultaneously "travel and explore" at the same time she pursued her career. Participant 8 echoed the desire to establish a "work-life balance" through "side career goals."

Participants have the opportunity to prioritize personal fulfillment due to the job market and low unemployment rates in the region. As Participant 10 articulated, "everywhere you go there's a help wanted sign." This reality was evident through the personal fulfillment aspects of the participants' career goals.

Learning Preferences

Participants identified their preferences for learning in general as well as for learning mathematics. Overall, participants reported they appreciated when they were presented information visually and auditorily so they could simultaneously see the concept and hear how to apply the concept or solve the mathematics problem. Five participants described themselves as visual learners, two participants stated they are hands-on learners, one identified as an auditory leaner, and four did not identify a specific learning preference.

However, the self-identified visual learners varied in their specific preferences, as some preferred to incorporate auditory learning, while others preferred to study a solution and figure out the concept or problem from there. Participants 2 and 7 preferred to listen and watch the instructor, but not their classmates. Participant 12 differed from Participants 2 and 7 as he did not prefer the auditory component. He stated, "I think one of my strengths when learning something is actually getting down to it instead of having someone tell you how to do it." Participant 9 agreed as she preferred to examine "worked out solutions—but no videos!"

Connected to the codes of class structure and participation expectations, both Participant 1 and Participant 11 noted that repetition was beneficial for them when it came to learning mathematics. In addition, Participant 10 stated that his attention to detail was important as he learned mathematical concepts. Participant 6 recognized that she prefers hands-on experiences. She stated, "I always think I prefer more hands-on stuff. Well, I can read it and then do it, but I'd rather have a hands-on experience, [it] is the best way I can learn, I think."

Strategies for Success

Participants identified strategies they employed to be successful in the developmental mathematics course including time management, utilizing the online learning platform, and improving focus. Although the strategies were implemented differently by each participant, Participant 10 summarized the success that resulted when these strategies were employed. He stated, "Math 100 definitely showed that just because I'm uncomfortable with something doesn't mean that I can't excel with enough work into it."

Time management was mentioned as something that participants either employed or wanted to improve. Participant 1 stated, "I very much like to make lists and check things off and I like to get stuff done." Participant 8 emphasized the role of time management and organization in her success. She stated that she would "take out my planner and figure out the order to do things and how to balance everything so I'm not so overwhelmed when I do have free time versus waiting until the very end to cram everything." Organization and time management strategies were noted as important factors that led to a successful learning experience.

The mastery-based online learning platform that is used for all Math 100 sections was cited as a helpful tool for maximizing course success. Participant 11 appreciated that she could learn different methods to approach a problem through the online learning platform and that she could try practice sets that did not count against her course grade. She stated that shorter sections and a variety of practice sets "keeps it fresh."

Improving one's focus and attention span by minimizing distractions was a common strategy for success that was mentioned by participants. Participants 1 and 4 relied on note taking to improve their focus. Participant 10 explained how he adjusted his space at home and added noise cancelling headphones to minimize distractions. The ability to minimize distractions and thus maximize one's attention span was a key component of a positive learning experience.

Application of Knowledge

All participants were able to identify at least one application of a mathematics concept they learned in Math 100 that they employed outside of the classroom. Some of the participants described applications directly connected to their program of study. Participant 5 used her

understanding of the metric system during her clinical rotations in the operating room. Participant 8 extended her understanding of formulas and equations to use spreadsheet applications more effectively at her place of employment. Participant 10 described how he used his knowledge of proportions to maximize timing and scaling at his workplace.

Other participants described applications that could be classified as life skills. Participant 1 discussed helping her daughter and coworkers grasp mental mathematics skills. Participants 2 and 8 used the mathematics skills they learned in Math 100 for prioritizing and budgeting since they lived independently. Participant 3 used his knowledge of fractions and ratios to prepare large meals at the homeless shelter. Both Participant 4 and Participant 6 used their geometry knowledge for home improvement projects including reseeding a lawn. Participant 11 was excited to share how her understanding of percent assists with identifying sales and maximizing her resources. In addition to using his mathematics skills for welding, Participant 12 calculated his fuel range when the fuel gauge on his vehicle was broken. Overall, participants valued being able to connect the concepts in Math 100 to a relevant purpose.

Support Network

Participants relied on a combination of instructors, classmates, tutors, friends, and family members as sources of support for the developmental mathematics course. Participant 3 mentioned his "funny and kind" instructor who was "really informative and really helps me a lot with explaining it to you." Participant 6 reported she was grateful for the support she received from her mathematics and program instructors when she had to step back from school for a period of time due to her father's illness and death. She shared:

> I reached out to my teachers to let them know what's going on, to kind of bear with me and help me out. [They] really helped me to make sure my grades were up, and did whatever they could do to help me out as much as they could.

Participant 7 echoed an appreciation for her kind instructor, especially that "she helped when she could and when you had questions or anything, she was right there, demonstrating and writing stuff on the board so you understood." Participant 5 preferred to meet with her instructor one-on-one because she "get[s] scared asking questions in front of a class," and her instructor could "show me a different way." Overall, participants leaned on instructors for both content and personal support.

The on-campus tutor was a helpful option for some, but not an accessible option for others. Friends and family were heavily depended upon by some participants to assist with figuring out mathematical concepts and to provide emotional support. Overall, participants valued both the content support and the emotional support that family and friends provided at various points during the developmental mathematics course.

Noncognitive Characteristics and Instructional Modalities

Similarities

The relevant code of goal setting within the *Growth and Career Advancement* theme was consistent regardless of instructional modality, specifically regarding long-term, career goals and advancement. Each participant clearly articulated how they planned to use their degree. The

clear, career-focused goals for the future provided the motivation necessary to persist through the challenges that arose at various points throughout the mathematics course. In addition to their specific careers, the participants expressed the desire to advance in their workplaces, to establish a work-life balance, to pursue further education, and to become business owners.

The first similarity within the *Learning Preferences* theme was the participants' preference for multiple approaches to learning. Each participant described more than one approach that assisted their learning with the visual learning style being referenced most frequently. Overall, participants appreciated a combination of detailed examples, explanations, videos, and opportunities to practice. Although the participants varied in their preferences, the findings do not align specific learning style preference with specific instructional modalities.

A second similarity within the *Learning Preferences* theme emerged regarding the participants' selection of their preferred course structure. The participants' responses indicated that they believed their modality selection would match their course structure preferences.

Given that the participants in this study self-selected their instructional modality, an interesting finding was the similarities regarding why a modality was intentionally selected. The participants in the traditional and hybrid instructional modalities preferred externally designated time to work on the course, dependable and consistent access to the instructor, timely feedback on performance, and content to be delivered in manageable amounts. The participants in the online instructional modalities desired the flexibility of the modality, preferred to work independently, and wanted to be given larger blocks of tasks so they could plan and process accordingly. The participants assumed that their preferences would be reflected in the course structure of their chosen instructional modality.

Differences

Three differences based on instructional modality emerged through the findings. Overall, the differences that were identified impacted the participants' engagement with the course content, their ability to adjust their learning environments, and their access to an embedded learning community. Although each of the participants expressed long-term career goals, the *Growth and Career Advancement* theme diverged by instructional modality when it came to the participants' goals for the developmental mathematics course. The traditional modality participants expressed a desire to learn and to gain a depth of knowledge. A traditional modality participant summed up her choice by stating, "I feel like I retain a lot more with physically being present. Seeing it and hearing it…there's things that I might not have thought, that somebody else would have. So altogether, I just think it's a more comprehensive learning environment." The hybrid modality participants also appreciated how the in-person component enhanced their learning. One hybrid participant stated, "For math, I wanted to have some sort of in-person instruction, because it's not really my strong suit...I knew if I really needed help, the option would always be there for me." She articulated that in addition to "checking off the Gen Ed requirement," she saw the course as a way to "freshen up" her mathematics skills since it had been a few years since she had a mathematics course.

Rather than sharing the course goal of deepening their learning or refreshing their mathematics skills like the traditional and hybrid modality participants, the online modality participants articulated that their goal for the course was to complete the general education requirement for their program of study. An online participant declared, "I took the online course

just to get it over with because it was required for my degree, and I didn't want to spend a ton of time on it." Another participant admitted he "really just wanted to get it out of the way," but he conceded that he did end up finding the course valuable.

The theme of *Strategies for Success* deviated by instructional modality selection when it came to how participants perceived their attention spans and responses to distractions.

When possible, participants intentionally selected the instructional modality that they felt would minimize distractions and maximize focus and productivity. Participants in the traditional instructional modality expressed the need to have structure and dedicated time to focus on the mathematics course. On the contrary, participants in the online instructional modality described feeling rushed in the traditional format and preferred to be able to work on the course independently at times and in locations of their choosing. The hybrid instructional modality participants appreciated the balance and flexibility of having both designated time to focus on the course and some independence to accommodate their schedules and commitments. Although not noted in the literature that was reviewed for this study, strategies for minimizing distractions and improving focus are critical in the effort to support student success.

The third theme that varied by instructional modality was *Support Network* in terms of the role or lack thereof of the course learning community. The embedded learning community within the traditional instructional modality provided participants an opportunity to interact with their classmates for content support, emotional support, and course and college navigation.

This sense of learning community was not evident in the hybrid and online instructional modalities. The hybrid instructional modality participants noted the presence of their classmates. However, they shared that they had limited interaction with their peers and expressed a desire for a more intentional, supportive learning community. The preference to learn independently without the requirement to engage with a learning community resonated through the reflections of the online instructional modality participants.

Discussion

The five themes that emerged from the interviews were growth and career advancement, learning preferences, strategies for success, application of knowledge, and support network. Growth and career advancement stems from goal setting which allows students to plan ahead and to defer gratification; it is considered a noncognitive characteristic in and of itself (Sedlacek, 2017). Given that the presence of having long-term goals is a predictor for college success as noted by Duckworth et al. (2007) as well as Fauria and Zellner (2015), a highlight from the study findings was that all nontraditional student participants articulated detailed short-term goals, such as gaining experience in their career field, as well as long-term goals including self-employment, additional education, and opportunities to use their skills creatively. Advancement in the workforce and personal fulfillment were cited as sources of motivation for the stated career goals. Guy et al. (2015) determined motivation had a statistically significant positive correlation with the final exam score in a developmental mathematics course. This study's findings provide context regarding the positive impact of motivation on the learning experience to such findings from a qualitative approach.

The *Learning Preferences* theme highlighted the overall uniqueness of each learner. The noncognitive characteristics of self-concept, realistic self-appraisal, and self-regulation were

evident in the participants' responses to the prompts. Students who employ self-regulated learning strategies are able to choose the type of instruction they need and to adjust their physical environment to their benefit. All three of these characteristics are related to academic success as evident in previous research (Fong, Zientek et al., 2015; Sedlacek, 2017).

Participants identified valuable strategies, such as time management, utilizing the online learning platform, and improving focus, that were employed to impact their learning experience through the *Strategies for Success* theme. Overall, participants exhibited self-awareness in terms of their strengths and opportunities for growth. The realistic self-appraisal of the participants in combination with their ability to identify and employ appropriate self-regulation strategies was an encouraging finding. This finding was consistent with the findings of Lawson et al. (2019) in a literature review regarding self-regulation. Given the time constraints and multiple responsibilities of nontraditional students, time management is a critical tool for success.

In addition, participants identified specific strategies, such as note taking and adapting their physical environment to improve their focus. This finding supports Kauffman's (2015) successful online learning profile and expands the profile to include a broader swath of nontraditional learners. Kauffman determined that successful online learners were self-aware, self-regulated, self-disciplined, and organized. The nontraditional participants from all three instructional modalities exhibited these characteristics.

An encouraging finding from the study was the role of the mastery-based online learning platform in the learning experience. Although technology can be a barrier to success as noted by Lowell and Morris (2019), and some participants noted the learning curve, the online learning platform was appreciated by the participants and viewed as a tool that promoted their course success. The particular online learning platform used for Math 100 promoted cognitive accessibility in terms of access to instructional content, multiple opportunities to practice, and immediate feedback on performance similar to a hybrid emporium model (Boatman & Kramer, 2019). However, the online learning platform in the Math 100 course was not administered in a self-paced format; thus it was not surprising that the findings varied from that of Beamer (2020) and Foshee et al. (2016). Those studies determined there was a decline in study skills and motivation for students who used online learning platforms. Broader than a specific learning platform, the findings highlight the necessity of access to and training regarding resources that support success and that assist in the navigation of the course and the institution.

As cited by the participants through the *Application of Knowledge* theme, application and relevancy are invaluable when it comes to supporting learning and improving the learning experience. All participants were able to identify at least one application of a mathematics concept they learned in Math 100 that they employed outside of the classroom. In addition, participants shared evidence of applying and extending the problem-solving strategies that are emphasized throughout the developmental mathematics course in workforce and home improvement situations. This finding supported the findings of Zientek et al. (2017) that determined mastery experiences and vicarious experiences are sources of self-efficacy for students.

A key finding within this theme was the participants' preference for and appreciation of the developmental mathematics course having a purpose beyond a general education requirement for their program of study. Contextualization of content ensures that learning happens for practical purposes and results in increased attention and motivation of students as cited by

several researchers (Keaton, 2018; Valenzuela, 2019; Wang et al., 2017). This preference and appreciation for contextualization was consistent with adult learning principles as noted by Merriam and Bierema (2014) and the National Research Council (2012).

The *Support Network* theme connects to the noncognitive characteristics of the availability of a strong support person and community. The presence of a support network fosters the development of a sense of belonging, which subsequently improves motivation, persistence, and academic performance as cited by Gilken and Johnson (2019). Support networks in the form of a learning community that one can identify with and draw support from are particularly valuable for nontraditional students (Sedlacek, 2017). Participants highlighted the importance of instructors, classmates, tutors, friends, and family members. Unsurprisingly, the participants in the traditional instructional modality relied on instructors, classmates, and on-campus tutors; the participants in the online instructional modality relied on friends and family members; and the hybrid modality participants relied on a combination of support persons.

In addition to content support, participants shared situations when their instructors, friends, and family members provided personal support during difficult life circumstances. This evidence points to the role of a community on the learning experience and highlighted the impact of social accessibility. From a classroom standing, social accessibility is described by Boatman and Kramer (2019) as multiple avenues to connect with instructors and deeper relationships with the instructors; however, this concept can be extended to the wider learning community and include all that serve in support roles.

Implications for Practice

The first implication for practice is the inclusion of noncognitive assessment tools in the placement process—particularly the instructional modality selection and placement. There is evidence that a multiple measures approach that includes a noncognitive characteristic component can increase placement accuracy and access to education (Ngo & Kwon, 2015; Ngo et al., 2018). Researchers have suggested models and tools for which to assess noncognitive characteristics and supplement the traditional cognitive placement measures (Boylan & Saxon, 2012; Sedlacek, 2004). Boylan's (2009) T.I.D.E.S. model assists in considering cognitive, affective, and personal factors when placing students in courses and connecting students with appropriate resources. The findings in this study corroborate the need to operationalize this model and utilize noncognitive assessment tools.

A second implication for practice was the identification of strategies and supports that are specific to both instructional modalities and nontraditional students. In reference to an emporium model, Beamer (2020) noted that it was critical for instructors to build rapport with students, assist in building motivation, and guide students into utilizing self-remediation strategies. These needs extend to all instructional modalities as all students benefit from setting goals, understanding their learning preferences, utilizing strategies, applying their knowledge, and being surrounded by a learning community. The need to cultivate a learning community is especially prevalent for students enrolled in online learning modalities. As the nontraditional student population continues to expand, institutions should ensure that resources are in place to support the population. Institutions should also consider how to be innovative in terms of addressing the needed flexibility of adult learners while ensuring the quality of the educational experience.

A third implication for practice is the development of professional development initiatives that assist in the recognition of noncognitive characteristics and the impact of those characteristics on the learning experience. Boylan and Saxon (2012) included investing in professional development for faculty as one of the top 10 best practices for developmental education programs. Given that noncognitive characteristics correlate with the academic success of all students by contributing to adjustment, motivation, and perception (Sedlacek, 2017), development opportunities for faculty and advisors regarding these characteristics ought to be prioritized.

Limitations and Recommendations for Future Research

There are a number of opportunities for future research based on the results of this study. It would be valuable to expand this study to additional populations such as traditional students, students from multiple institutions, and students enrolled in specific academic programs to explore additional perspectives as this study was limited to nontraditional students. This study focused on the three instructional modalities that were offered at the research site. A replication of the study with additional instructional modalities, acceleration models, and contextualization models may prove to be beneficial so that the perceptions of the learning experiences across a variety of modalities and models could be considered. This study was further limited in that interviews were the primary data collection method and thus responses were self-reported. Ultimately this study ought to be combined with other studies, both quantitative and qualitative, to provide a comprehensive picture of the role of noncognitive characteristics on the learning experience.

Conclusion

This phenomenological qualitative study explored how noncognitive characteristics impacted the learning experiences of technical college developmental mathematics students. The experiences of the nontraditional mathematics students focused on the role of growth and career advancement, learning preferences, strategies for success, application of knowledge, and support networks on their success. Although the emergent themes were consistent across the three instructional modalities, specific similarities were noted across the instructional modalities regarding long-term career goals, the preference for multiple approaches to learning, and the connection between modality selection and preferred course structure. The relevant codes diverged by modality when it came to personal course goals, strategies for minimizing distractions, and the role of the learning community. This study contributed to building the body of literature by specifically exploring how noncognitive characteristics affect the learning experience of nontraditional students in various instructional modalities of a developmental mathematics course at a postsecondary technical college. The findings could inform the development of multiple measures course placement processes that incorporate noncognitive characteristics as well as inform the incorporation of strategies and supports in specific instructional modalities.

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Appendix A

Interview Protocol

- Please tell me about yourself and your background.
- Which instructional modality are you enrolled in?
- Why did you enroll in this instructional modality?
    - Was this your preferred choice? Please explain.
- Discuss your strengths related to learning.
    - Describe your strengths related to learning math.
- Discuss your areas for improvement related to learning.
    - Describe your areas for improvement related to learning math
- Describe a situation during the course where things were working against you. How did you handle the situation?
- What were your goals for the Math 100 course?
    - What are your long-term goals?
- Describe a time when the course was difficult.
    - Where did you go or who did you turn to for help?
- Discuss a situation where you have shown leadership – either at the college or in the community.
- Describe what the learning community was like in your Math 100 course.
- Share something you have learned about mathematics outside of the course.
- Is there anything else you would like to share with me about your learning experience in Math 100?