Students' Experiences Learning in the Emporium Model: A Conceptual Analysis

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Abstract

The purpose of this paper is to capture and analyze students' experiences learning within an Emporium Model (E-Model) of both learning support and introductory college-level mathematics courses. Participants (n =163) were asked their perceptions regarding the E-model approach. Contextual analysis was used to code participants' responses. Participant comments revealed overwhelming favorability of the E-Model while highlighting the ramifications of learning in a more self-directed learning environment. The paper concludes with applicable recommendations for enhanced sustainability of the E-Model design for course instruction.

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Course redesign initiatives at two-year and four-year colleges and universities across the country have been growing in popularity over the past two decades (Twigg, 2015). Institutions of higher learning have been seeking effective ways to close achievement gaps and improve student retention and success rates in Learning Support Mathematics (LSM) courses and high-enrollment college introductory courses (e.g., College Mathematics, English, Introductory Psychology) which affect historically underrepresented, low-income and first-generation groups at a disproportionate rate (Nietzel, 2020). One of the earliest course redesign initiatives was developed through the National Center for Academic Transformation (NCAT) in 1999 (Twigg, 2011). NCAT was a non-profit organization that focused on using information technology to enhance learning at reduced costs (Twigg, 2011). NCAT's resources are currently managed by the University of Central Florida (Nietzel, 2020).

Low retention and high failure rates, particularly in mathematics courses, motivated postsecondary institutions across the country to seek alternative ways for improving student performance (Bonham & Boylan, 2012; Schak, 2017). Of particular focus in the current study is the Emporium Model (E-Model) design for course instruction. Examination of the E-Model methodology is of great significance because the model or elements of the model are embedded within the structure of some Learning Centers (e.g., the Academic Success Center at the University of South Florida). The E-Model is one of the six course redesign models endorsed and further streamlined through NCAT. The unique aspect of the model was the required elimination of lecture-based instruction by transforming learning environments into A*ctively-Engaged Learning Spaces* (AELS). The E-Model was designed to be more student-centered, which included the incorporation of educational technology as a central component to enhance the learning experience of students.

The E-Model was demonstrated to be an effective course delivery approach within the *Changing the Equation* (CTE) program initiative designed specifically to help two-year colleges with redesign efforts of LSM sequence courses and programs (Twigg, 2011). In the past decade, a growing number of empirical research studies have shown promising evidence of the effectiveness of the E-Model design in comparison to the traditional lecture-based approach, primarily through the analysis of completion rates and end, of course, test scores (Eckhardt, 2016; Krupa et al., 2015; Webel, Krupa, & McManus, 2017; Vallade, 2013; Williams, 2016) as well as positive psychological outcomes (Helming & Schweinle, 2014; Pachlhofer, 2017). Additionally, existing literature has expounded on the relationship between students' attitudes toward mathematics and technology and how these attributes affect students' achievement (Korobili, Tioga, & Malabari, 2010; Ku, Harter, Liu, Thompson, & Cheng, 2007). Notably, Bonham and Boylan (2012) recognized the rise in the use of technology to engage students on formative and summative assessments by indicating that "a major disadvantage can be an overreliance on the technology to deliver instruction with little or no intervention, even when students are experiencing difficulty" (p. 16).

While there is literature indicating positive results using the E-Model design, the format of the learning environment alone can have adverse effects on some students' performance (Kargar, Tarmizi, & Bayat, 2010). For example, some of the challenging issues that arise in self-directed learning environments are psychologically related (e.g., affective, low self-esteem, self-efficacy, or motivational), and these challenges are particularly relevant for students who struggle with learning mathematics (Gibson, 2019). These students tend to have initial preconceived negative notions about their abilities to perform, which can be magnified in computer-assisted learning environments (Miranda, 2014). Typically, these students have lower levels of intrinsic motivation (i.e., the highest level of autonomous or self-determined motivation) and are more likely to be motivated by extrinsic factors (i.e., lower levels of autonomous controlled forms of motivation) (Cho & Heron, 2015).

For some marginalized groups of students, racial disparities may provide some insight into their preconceived negative perceptions. Research has found that motivational predispositions of Black Americans stem, in part, from internalized racial oppression (Brown, Rosnick, & Segrist, 2017). These authors found that Black males, in particular, were more prone to have an unfavorable view of their higher education values (i.e., beliefs about the role of the educational system to support their academic aspirations or expectations) than their counterparts and tend to have a more external locus of control and believed external factors in their social environments influenced their goal aspirations. Other research suggests this disparity for Black males may be a product of "academic disengagement", most notably, at community colleges stemming from their perceptions of possibly being perceived as "intellectually inferior" (Woods, 2014). In general, research has found that "multidimensional layers" of racism (i.e., individual, institutional, and cultural) has influenced the educational aspirations of Black and Brown students of color (Reynolds, Sneva, & Beehler, 2010).

Learning in the E-Model can present students with challenges that may affect their motivation to succeed that may stem from previous negative experiences using computers or interactive software (Miranda, 2014) and other factors that continue to plague marginalized populations of students. These challenges can be exacerbated in learning environments that are designed to be self-directed (Gibson, 2019). Interestingly, courses or programs developed within a theoretical framework are more likely to be effective and sustainable (Mireles, 2010). The purpose of the current paper is to further understand students' perceptions of learning in the E-Model design for course instruction that represents a learning environment that is more suitable for students who are autonomous and self-directed.

Background and Theoretical Framework

According to Liaw (2002), examining students' perceptions of learning in a web-based or computer-aided instructional environment would be an asset to the implementation and sustainability efforts of course delivery. Since 1999 institutions of higher learning have typically used the six course redesign models (i.e., supplemental, replacement, emporium, buffet, fully-online, and linked workshop) to create high-quality learning environments using technology at reduced costs (Gibson, 2019). The current study seeks to augment this literature by focusing on students' perceptions and insights as a result of learning experiences with the E-Model design for course instruction.

The E-Model

The E-Model requires complete replacement of the traditional instructional approach (i.e., lecture-based) in a computer learning environment using a Computer Learning System (CLS) as the central component to deliver and enhance the learning experience (Twigg, 2011). The E-Model design was adopted from the *Math Emporium* model originally developed at Virginia Tech during the initial redesign efforts of a linear algebra course in Fall 1997 (Twigg, 2011). Additionally, the E-Model design relied on a CLS, internet-based activities, and assessments with on-demand and personalized assistance (Twigg, 2011). Although computer-based, the model design was flexible. Some designs included a one-hour face-to-face meeting in a classroom once a week to reinforce concepts or to meet and discuss progress as well as any other student concerns. For example, one redesign approach included a classroom learning component that was more student-centered and focused on discussing "big ideas" in engaging collaborative-group settings where course delivery was primarily within a computer learning space (e.g., lab classroom or learning commons; see Etheridge, Monroe-Ellis, & Tankersley, 2014). As such, students used a CLS to complete their individualized mathematics curriculum.

E-Model Components

The success of the E-Model design depended on the implementation of ten essential elements (Twigg, 2011, 2015). These essential elements could be divided into two categories: those that consisted of the *Core Structural Elements* (CSEs) of the redesigned model and the *Strategic Operational Elements* (SOEs) of the model. These two components describe the foundational aspects of the E-Model and the activities that took place to support active-student engagement to maximize discourse between the student, instructor, or tutor. Table 1 lists the ten essential elements of the E-Model. More information regarding the implementation of the E-Model methodology can be found at https://www.thencat.org/Guides/Math/TOC.html.

Table 1.

The 10 Essential Elements of the E-Model Design

Core Structural Elements	Strategic Operational Elements
• Redesign whole course learning environments.	• Ensure active student engagement.
• Modularize the course content.	• Provide ongoing assessment with computerized feedback.
• Require mastery learning.	• Provide one-on-one access to trained professionals
• Measure learning outcomes, completion rates, and cost-efficiency.	• Ensure the availability of adequate time on tasks.
• Computerize all learning environments using a CLS.	• Monitor student success and provide needed assistance.

Theoretical Framework

Several theories provided a framework for assessing the effectiveness of the E-Model design to support students' *Basic Psychological Needs* (BPN) for learning in student-directed learning spaces (Gibson, 2019). The overarching theoretical framework was rooted in Self-Determination Theory (SDT; Ryan & Deci, 2017). SDT asserts that all humans have an innate desire to strive for a sense of *autonomy* (i.e., the need to feel free and self-directed), *competence* (i.e., the need to feel capable of performing), and *relatedness* (i.e., the need to feel a sense of belonging) – the BPN to function and grow within unique social settings. Notably, autonomy in SDT is volitional behavior (i.e., a willingness to do or perform). In AELS, students have a choice to be autonomously independent (i.e., having the choice to work alone) or autonomously dependent (i.e., having the choice to seek out guidance or assistance).

The Principal Investigator's Relationship to the Study

The qualitative analysis and interpretation of findings were carried out by the Principal Investigator (PI) (i.e., the first author of the study). The PI has been an educator of introductory college-level mathematics courses since 2006 and has taught LSM courses and co-requisite college-level introductory mathematics courses since 2009. For the past eleven years, the PI has been interested in, taught, and developed AELS as an alternative to the lecture-based approach to improve student learning outcomes. Since 2014, the PI has used SDT as a theoretical foundation for developing AELS to create learning environments where the less autonomous learners have the opportunity to become more autonomously-natured in non-lecture-based learning experiences. Additionally, the PI has an interest in learning more about students' perceptions of learning in AELS, such as the E-Model and evaluating whether these types of learning environments are autonomy-supportive of students' BPN to improve students' learning potential.

Methods

Participants

There were 463 adult participants from a Midwestern community college and a four-year public university and a Southeastern four-year public who consented to participate in a broader study (Gibson, 2019). The broader study focused on the beginning phase of the development and validation process of items of a survey instrument designed to identify constructs that could be used to assess whether the E-Model methodology supports students' BPN. Exploratory Factor Analysis results yielded four parsimonious factor solutions representing autonomous learning needs, valuing educational technology, instructor/tutor relatedness, and the use of metacognitive self-regulated learning strategies.

In the current paper, participants at the community college were LSM students, who were predominately non-traditional (i.e., at least 25 years of age). Participants at the public university were a mix of

LSM students and those enrolled in college-level introductory mathematics courses (e.g., College Algebra, Finite Mathematics, Pre-Calculus) and were predominately more traditional students – those 24 years of age or less. The E-Model design was implemented at both institutions. Of the 463 participants, 35% (n = 163) responded to the open-ended prompt regarding their personal experiences within the E-Model curricular approach.

Materials and Procedure

The current paper seeks to understand students' perceptions of learning in a self-directed learning environment presented through the E-Model. The research design consists of a "qualitative mixed" paradigm that incorporates qualitative and quantitative data analytic techniques (Johnson, Onwuegbuzie, & Turner, 2007). The study is semi-sequential – in that, the qualitative data were further quantified to illustrate the quantitative depth of the derived themes and to provide supportive descriptive information of specific demographics. The data collected were comments from participants who responded to an open-ended survey prompt assessing the effectiveness of the E-Model to be autonomy-supportive, which required using qualitative data analysis to capture individual participant's perspectives. More specifically, *representational thematic text analysis* was used to assign themes to the text of respondents, which is a version of *context analysis* (Popping, 2015). The process of carrying out the text analysis was *inductive coding* (Thomas, 2003).

The PI followed the guidelines discussed in Popping (2015) and the inductive approach in Thomas (2003) for identifying themes and coding specific text. In addition to inductive coding, numerical codes were used to quantify themes given that all responses could be categorized in one of the identified themes.

Participants responded to the following open-ended question embedded in the broader study: "Is there anything else that you would like to share regarding your learning experiences in the E-Model environment?" The reason for including the open-ended prompt was to obtain additional information that would not be attainable from the closed-ended responses of the survey (Popping, 2015). Participants responded to the survey electronically through their institutional e-mail accounts. Following this approach, the goal for analyzing the comments was to use the theoretical framework (i.e., SDT) to assess whether the E-Model design was supportive of students' BPN, given the derived themes.

Item Analysis Procedure

According to Popping (2015), open-ended responses from surveys were often filled with grammatical errors and other textual problems. The author suggested that in some cases, corrections could be made without changing the meaning of the participant's comments. For transparency purposes, there were a few bracket-enclosed corrections made within comments that contained grammatical, or punctuation errors, or symbolic errors that occurred while exporting the data (e.g., changing *didnâ€™t* to [didn't]). Comments were exported to an Excel file for analysis. The analysis process was three-fold: 1) derive emergent themes from students' responses, 2) determine whether derived themes represented an impediment of students' BPN; and 3) assign numerical code to derived themes and BPN impediment traits to compute demographics, attitudinal, and BPN impediment percentages.

To begin the process of identifying themes, the PI read through all responses. During this initial read, it was apparent that the responses could be categorized into three overarching themes. The responses either expressed *negative attitudes* (e.g., "I did not like this at all, was a terrible way to teach and try to understand math."), *positive attitudes* (e.g., "I enjoyed the pace and how on task I became."), or responses that suggested *needs improvement* or *change* (e.g., "More tutors in the lab would be helpful to the students."). Following the initial read-through, the PI read through the responses a second time to assign numeric codes and connect participants' responses with respective themes.

Before a third and final read, the negative responses were further analyzed to determine whether a response was associated with an impediment of autonomy, competence, or relatedness – that is, the three BPNs to function and grow within social settings as defined by SDT. Furthermore, negative comments were associated with specific aspects of the E-Model learning experience that potentially disrupted students' BPNs (e.g., not liking the CLS, not connecting with the instructor/tutor, or hated taking quizzes in the lab). These comments were coded based on whether students' dislike was related to *impeding autonomy* (e.g., "I am not a huge fan of the e-learning environment. I prefer to be tutored one on one with an instructor or a tutor with math."), *impeding competence* (e.g., "Honestly I felt a little bothered by the whole thing. I grasped the importance of the class and its substance, but the E-model did not do that great for me. I still felt intimidated and unprepared), or *impeding relatedness* (e.g., "In the E-Model learning environment, I had a tutor say, "You [don't] know how to do this?" Then I said no, and he just told me the answer[,] which [doesn't] help at all."). Otherwise, the comments were coded *autonomy-supportive* – indicating no hindrance to students' BPN. For example, one respondent stated:

> "This way of taking the class benefits everyone in the class. Everyone in the class is able to work in the way that suits them best and work at their own pace. You don't have to wait for the class to move on to the next lesson. You can work ahead and work as fast or slow (to an extent) whatever is best for you."

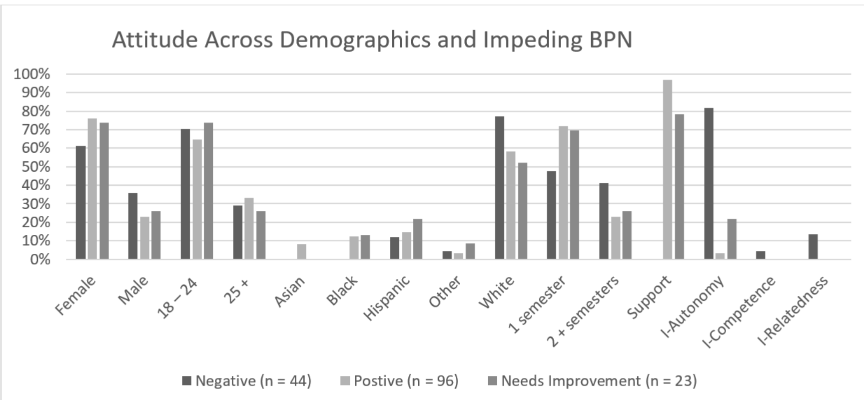
Furthermore, the needs improvement responses were further analyzed to determine if they were associated with an impediment by referring to the closed-ended responses provided by respondents. If the average of the response scores provided by a respondent for a BPN was less than 4 (i.e., on a Likert type 7-point scale), the needs improvement response was categorized as an impediment of the BPN construct.

Results

Figure 1 displays the demographic and impeding BPN attitudinal results for the percentages of negative, positive, and needs improvement themes. There were more than twice (2.2 times) as many positive comments (59%) than negative comments (27%) while the rest of the comments (14%) suggested needs for improvement or a notion of change for $n = 163$. From a visual inspection of Figure 1, female respondents provided the most comments for each category (i.e., negative [61%], positive [76%], and needs improvement [74%]), while at most 36% of comments per category were from male respondents (i.e., 36%, 23%, and 26% respectively). The age group 18 – 24 provided the most comments (i.e., negative [71%], positive [65%], and needs improvement [74%]), while less than 16% of comments were from participants at least 25 years of age. Of the ethnic groups, White respondents provided the most comments (i.e., negative [77%], positive [58%], and needs improvement [52%]), while less than 22% of comments were from the other ethnic groups represented. Respondents who needed one semester to complete course work provided more comments (i.e., negative [48%], positive [72%], and needs improvement [70%]) than those who needed more time to complete course work, which was less than 23% overall. Notably, results in the current paper were similar to the demographic results in the broader study in which more participants were female, young, White, and those who completed their coursework in one semester.

Figure 1.

Demographics and Impeding BPN Attitudes



Lastly, an inspection of the "Support" variable in Figure 1 shows that approximately 97% ($n = 96$) of respondents provided positive comments and 78% ($n = 23$) provided needs improvement comments from the respective themes. Notably, the needs improvement comments under the support variable were from respondents who responded favorably with a response scale score greater than 4 on the closed-ended response items in the broader research study regarding their BPN. Moreover, the impeding BPN results (i.e., I-Autonomy, I-Competence, and I-Relatedness) in

Figure 1 provide additional information regarding the challenges faced by respondents who overwhelmingly felt that their autonomy was hindered (i.e., negative [82%], positive [3%], needs improvement [22%]. Further analysis of the negative comments, expressed by respondents, indicated a hindrance of competence (5%) and relatedness (14%).

Tables 2 and 3 provide additional context highlighting emergent themes, and example comments identified from students' responses. The themes in Table 2 consist of sample negative, positive, and needs improvement responses. Table 3 consists of the impeding BPN themes that are representative of negative comments specific to a BPN construct, while the support theme consists of all other comments that did not suggest a hindrance of a BPN construct.

Table 2.

Description of Attitudinal Themes and Sample Comments

Themes	Comments
Negative Attitude	Comments that indicated a dislike for any aspect of the E-Model learning experience. For example, *"I did not like the limited hours we could do the homework. I usually felt rushed and forced to go there..."* *"I truly hate it. I understand the need for it. I still think it de-personalized math and took any semblance of enjoyment out of it."*
Positive Attitude	Comments that indicated praise of any aspect of the E-Model learning experience. For example, *"I much preferred the E-Model over the traditional way of learning mathematics!"* *"I liked that each module was broken down into sections and allowed us to master a concept before moving on to the next one ..."*
Needs Improvement	Comments that suggested a need for improvement or general statement eluding to change. For example, *"Attendance should only be required for taking tests and quizzes."* *"I liked the [Lab], but I believe we need more qualified tutors in there. So many times I would wait 20 [minutes] for a tutor, who did not know Pre Calc then I had to wait another 20 [minutes] for another tutor."*

Note. All comments labeled as needs improvement were further analyzed and were placed in one of the four subgroups in Table 3.

Table 3.

Support and Impeding Basic Psychological Needs (BPN)

Themes	BPN Descriptions
Support	All positive comments (i.e., representing autonomy-support). *"I was homeschooled during my elementary school years and then attended an online international high school - because of these experiences, I know that I excel in a self-motivated goal set environment where I may work alone a lot of the time, and problem solve until I need help. It isn't that I won't ask for help from my instructors - instead, it is simply that I am quite comfortable working in an environment where I guide the "ship" so to speak. :)"* *"E-model learning is mostly on your own. The only time I came into contact with an instructor was when I had a question. This may be beneficial to some or not to others. If [you're] looking to work mostly on your own and be responsible for your own learning, then E-learning is the right course for you."*
Impeding Autonomy	Negative comments that suggested general autonomy was affected or eluded to competence or relatedness as disruptors of BPN per the closed-ended responses of the constructs. For example, *"I did not like learning math this way. I liked the self-pace when it came to stuff I was familiar with, but with more advanced math it was a nightmare. It was no fun trying to teach myself something I did not know."* *"I did not like the modules. I thought they were hard. Mainly because learning a subject online is not my learning style. I prefer a face to face class where the teacher teaches you, not a computer. Also, the modules were very frustrating, to say the least."*

Impeding Competence	Comments that were negative and suggested competence as a potential disruptor. For example, "*E-Model [isn't] for everyone and I personally struggled. Not because the material was hard but because I limited myself and did not have the confidence I had when I first enrolled*."
Impeding Relatedness	Comments that were negative and suggested instructor/tutor relatedness as a potential disruptor. For example, "*Usually the staff in the lab that I had to take those courses in looked bored or irritated to be there. I wasn't inclined to ask them questions because it looked like a chore when I still didn't understand something. Sometimes I'd need more explanation and the online course and lab instructor still left me confused, wondering what exactly I needed to do.*" "*The E-Model learning environment was terrible. Not only was I told different things by my professor, textbook, and computer software, but I also was told something different by every individual tutor in the lab*."

Interpretation of Findings

The comments offered by participants in this study are informative. The comments either expressed the more autonomous or self-determined forms of motivational learning in the E-Model (e.g., "I was really scared trying it out since I hated math but it helped me be so confident now…") or signaled concern indicating how a learning environment that was designed for the more autonomous learner could impede an individuals' ability to succeed in the E-Model learning space (e.g., "Strongly dislike it. I never finish in time. Having to retake the course is extremely frustrating.").

Interestingly, while there were more comments from younger respondents, the comments from older respondents were slightly more favorable of a self-directed learning experience (e.g., "As a 43-year-old male, the E-Model feels more natural to my sense and allows me to absorb the information faster."). Research offers a possible reason for this trend – that is, younger respondents will more likely be less autonomous at the beginning of their academic careers and will more likely have difficulty adapting to self-directed learning environments, while older respondents will have gained more adult related responsibilities and will be more self-directed (Cullaty, 2011). Additionally, results in Figure 1 suggest that students who completed their course work in the first semester had a more favorable perception of learning in the E-Model (e.g., "I believed the class was very beneficial…" or "I had a very good experience with the E-Model learning environment…").

Study results were more aligned with research suggesting the E-Model learning environment was better suited to be autonomy-supportive (Brey & Tangney, 2017; William, 2016) and promoted positive outcomes (Gagne, 2003). The data presented in this study support this claim. Notably, several respondents expressed the importance of needed autonomy-support (e.g., "I think the E-Model is a great environment to learn with the help of the tutors. However, I think that having my professor be more hands-on would be helpful.").

Another respondent expressed the following:

> "I believe teachers are very necessary in these classes to make them work. I've done a pace class without a teacher at another school and hated it, but I love these ones with set class, times, and the teacher."

On the other hand, the absence of needed autonomy-support can create unnecessary frustrating situations. One respondent stated the following:

> "I have spent more time teaching myself this material than if I had access to a regular traditional course. It was frustrating and discouraging to me."

Additionally, results were consistent with other research studies suggesting that the E-Model methodology positively impacted students' motivation and performance (Eckhardt, 2016; Komarraju & Nadler, 2013). Respondents also indicated how the E-Model environment helped them gain confidence in their abilities to learn mathematics and set goals, which is a component of self-regulated learning. Another respondent stated, "I was able to move at my own pace and accelerate to the next level of math quickly. E-Model learning gave me the ability to set goals for myself." Statements similar to these reflected the idea that positive learning experiences in the E-Model environment can influence students' mindset and performance in a positive way (Eckhardt, 2016). "… As someone who has always struggled with math, this was amazing. It really changed my opinion on math in general."

Discussion

The theoretical framework of the current research study was rooted in SDT. The applicability of SDT in the E-Model design required that students have the necessary skills and autonomy-support to be successful throughout the semester. Self-directed learning spaces cater to students with the right mindset. As discussed, there will most likely be students who have preconceived negative notions about their abilities to perform in more self-directed learning spaces (Kargar et. al., 2010; Miranda, 2014). Therefore, there must be in place a structured well-implemented process (SWIP) that will promote autonomy-supportive instructional behaviors to avoid the occurrence of psychological ramifications of learning in the E-Model. The following components are applicable and can function as a SWIP to enhance the learning experience in self-directed learning spaces. Notably, this is not an exhaustive selection of components, but recommendations based on SDT, students' responses, and ten plus years of experience by at least one of the authors of the current study working in AELS.

Benefits of Adopting an Applicable Theoretical Framework

Three indicators of success in the E-Model include: 1) students' *willingness* to be engaged, 2) performance indicators, and 3) BPN satisfaction. The E-Model appears to be better suited for supporting self-directed learners and can provide the opportunity for the less autonomous learners to become more autonomous (Ryan & Deci, 2017). Whole-heartedly adopting SDT provides a theoretical basis for assessing the effectiveness of the E-Model design to be autonomy-supportive of all students. Accommodating students' BPN can promote students' ability to become more self-directed, confident in their abilities, and comfortable with the learning experience, which can promote a willingness to succeed after failure (e.g., "…Although I have failed the module I'm on in the past, I have confidence in learning the material because of the E-Model Learning environment."). Numerous research studies in SDT have provided evidence-based empirical results supporting the fundamental essence of SDT – many of which are accessible on the website of the Center for Self-Determination Theory (CSDT) at https://selfdeterminationtheory.org/.

Providing a Rationale for New Innovations

A key recommendation in SDT research is to provide a rationale for innovative learning approaches to avoid frustrating students (Ryan & Deci, 2017). Our results suggest an issue with messaging or communicating the purpose for learning in AELS that could be

"…great for people that know how to pace themselves and enjoy learning on their own," as one respondent stated. When students are not prepared to learn in a self-directed learning environment, such as the E-Model, the leaning space becomes a hindrance and can create unnecessary frustrating learning experiences for students.

As previously stated, students attending college for the first time may be less autonomous at the beginning of their academics (Cullaty, 2011). Learning in an environment that requires self-regulation can create more frustrating situations for these students given that most will not have had prior learning experiences in learning spaces designed to prepare them to "…excel in a self-motivated goal set environment..." These students will most likely "…prefer a face to face class where the teacher teaches you, not a computer," according to one respondent. A working rationale could focus on expressing the benefits of the new learning approach. For example, 1) developing college-ready skills (i.e., becoming more self-directed using self-regulated learning strategies), 2) building confidence in one's abilities to perform, 3) developing a growth mindset about learning potential, and 4) helping students understand that learning takes place when they are actively engaged in the learning process. The E-Model design provides a learning space for students to develop the skill set necessary to achieve success academically and beyond.

Adopting Autonomy-Supportive Instructional Behaviors

Several responses from participants revealed another potential need – adding a new Core Structural Element (CSE) component (i.e., support a growth mindset to combat psychological barriers). According to Reeves and Jang (2006), autonomy-supportive instructional behaviors (e.g., listening to students, encouraging students' effort, offering progress-enabling hints, being responsive to students' comments and questions) were found to be positively correlated with students' autonomous motivation more so than more controlling forms of instructional behaviors (e.g., making demands and directives, using controlling words such as *should* or *have to*, or telling students answers without allowing them to formulate the solution on their own). At the root of SDT, one of the innate desires of all humans is to strive for relatedness (Ryan & Deci, 2017). Therefore, the success of students' transition into becoming more autonomous or self-directed, depends on the effectiveness of the support received. This support can come in the form of *emotional support* or *instrumental support* (Federici & Skaalvik, 2014). Emotional support comes in several forms that reflect emotion (e.g., caring or empathizing, gaining trust, or showing respect expressed through communication; Patrick, Kaplan, & Ryan, 2011). Instrumental support is usually related to forms of instruction (e.g., explaining concepts, instructor facilitation, or inquiry; Federici & Skaalvik, 2014).

Supporting the Use of Meta-Cognitive Self-Regulated Learning Strategies (MC-SRLS)

Learning in the E-Model requires students to be more self-directed, responsible, and gain more ownership of their learning (Cho & Kim, 2013). Evidence of the self-directed nature of the E-Model learning environment was expressed by one respondent stating: "…If you're looking to work mostly on your own and be responsible for your own learning, then the E-Model is the right course for you." Self-directed learners utilized metacognition and self-regulated learning strategies to help them succeed. Metacognition is one way to enhance a more self-directed learning experience, which can be defined as the process of "thinking about thinking" (Owen & Vista, 2017). When students were users of MC-SRLS they became more self-determined (Chung, 2005). MC-SRLS involves developing a plan of learning (e.g., peer-study-groups, reading instructor's notes, using available resources), monitoring progress (e.g., using forms of self-assessing of knowledge), and evaluation (i.e., assessing the effectiveness of the planned approach). Research has shown that when learning spaces were supportive of students' BPN, it mediated the relationship between autonomy-supportive environments and positive outcomes (Gagne, 2003).

In closing, it is important to keep in mind that this research does not dismiss the fact that there are external factors, with varying degrees of severity, that have the potential to affect students' autonomy negatively. The paper focuses on how the E-Model methodology can serve as an intervention to support the innate desires of autonomy, competence, and relatedness for all students and highlights ramifications when students are not prepared to learn in self-directed learning spaces. Students will need autonomy-support to achieve success academically and beyond despite the external challenges they may face within their unique social settings. Students desire to feel a sense of relatedness or connection to their learning communities. The relationship between the instructor and student is paramount, particularly, for marginalized populations of students who are predominately victims of economic, social, and educational disparities.

Post-secondary institutions have a responsibility to put in place norms that will foster an inclusive and welcoming learning community. Norms that include resources to support innovative learning initiatives, such as, implementing the E-Model methodology and other services within the organization that will be needed to support student engagement initiatives as well as faculty and staff professional development opportunities. There should be an examination of policies and practices to ensure they are inclusive and supportive of the expansive marginalized populations of students that will be necessary to address other potential elusive forms of institutional biases. A commitment to diversifying the administration and faculty body is a start. Representation matters a great deal to students of color who attend colleges and universities that are predominately White where they may feel more "racism-related stress" (Reynolds, Sneva, Beehler, 2010).

Lastly, findings reveal the substantial potential for implementing the E-Model course redesign to help students become more self-directed and self-regulating. The E-Model offers students an actively-engaged learning environment with a choice to work autonomously independent or dependent. Results demonstrate that students became more self-directed and self-regulating when they had the opportunity to thrive and grow in AELS that were: 1) autonomy-supportive, 2) provided the opportunity to build competence, and 3) supported the need to feel a sense of relatedness to the instructor or belonging in the learning space. Hence, the essence of SDT – the BPN to become more full-functioning and succeed in academic and social settings (Ryan & Deci, 2017).

References

Bonham, B. S., & Boylan, H. R. (2012). Developmental mathematics: Challenges, promising practices, and recent initiatives. *Journal of Developmental Education, 36*(2), 14 – 21.

Brown, D. L., Rosnick, C. B., & Segrist, D. J. (2017). Internalized racial oppression and higher education values: The mediational role of academic locus of control among college African American men and women. *Journal of Black Psychology*, *43*(4), 358–380.

Cho, M.-H., & Kim, B. J. (2013). Students' self-regulation for interaction with others in online learning environments. *The Internet and Higher Education*, *17*(1), 69–75. doi:10.1016/j.iheduc.2012.11.001

Cullaty, B. (2011). The role of parental involvement in the autonomy development of traditional-age college students. *Journal of College Student Development*, 52(4), 425 – 439. doi: 10.1353/csd.20110048

Eckhardt, R. J. (2016). *A Program Evaluation of a Redesigned Developmental Mathematics Program at Manchester Community College*. (Doctoral Dissertation). Available at ProQuest Dissertations and Theses. (UMI No. 10255799)

Etheridge, S., Monroe-Ellis, M., Tankersley, A. (2014). A model for redesigning developmental mathematics based on AMATYC standards and basic principles of beyond crossroads. *MathAMATYC Educator*, *5*(3), 21 – 26.

Federici, R. A., & Skaalvik, E. M., (2014). Students' perceptions of emotional and instrumental teacher support: Relations with motivational and emotional responses. *International Education Studies*, *7*(1), 21 – 36. doi: 10.5539/ies.v7n1p21

Gagne, M., Ryan, R. M., & Bargmann, K. (2003). Autonomy support and need satisfaction in the motivation and well-being of gymnasts. *Journal of Applied Sport Psychology*, *15*(4), 372–390. doi: 10.1080/714044203

Gibson, T.O. (2019). *The Development and Validation of the Emporium Model Motivation Scale (EMMS)*. Unpublished Dissertation, The University of Tennessee, Knoxville, Tennessee.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, *1*(2), 112-133. doi: 10.1177/1558689806298224

Kargar, M., Tarmizi, R. A., & Bayat, S. (2010). Relationship between mathematical thinking, mathematics anxiety and mathematics attitude among university students. *Procedia – Social and Behavioral Sciences 8*(2012), 537 – 542. doi: 10.1016/j.sbspro.2012.12.074

Krupa, E. E., Webel, C., & McManus, J. (2015). Undergraduate students' knowledge of algebra: Evaluating the impact of computer-based and traditional learning Environments, *Problems, Resources, and Issues in Undergraduate Studies* [PRIMUS], *25*(1), 13 – 30. doi: 10.1080/10511970.2014.8976

Korobili, S., Togia, A., & Malliari, A. (2010). Computer anxiety and attitude among undergraduate students in Greece. *Computers in Human Behavior, 26*(3), 399 – 405. doi: 10.1016/j.chb.2009.11.011

Ku, H-Y., Harter, C.A., Liu, P-Y., Thompson, L., Cheng, Y-C. (2007). The effects of individually personalized computer based instructional program on solving mathematics problems. *Computers in Human Behavior, 23*(3), 1195 – 1210.

Liaw, S. (2002). An internet survey for perceptions of computers and the World Wide Web: Relationship, prediction, and difference. *Computers in Human Behavior*, *18*(1), 17 – 35. doi: 10.1016/S0747-5632(01)00032-2

Miranda, J. (2014). The Efficacy of an Interactive Computer System for Teaching Developmental Mathematics to College Students" (2014). *FIU Electronic Theses and Dissertations*. 1148. https://digitalcommons.fiu.edu/etd/1148 doi: 10.25184/etd.FI14040831

Mireles, S.V. (2010). Theory to practice developmental mathematics program: A model for change. *Journal of College Reading and Learning*, *40*(2), 81 – 90.

Nietzel, M.T. (2020, February 6). College initiatives for 2020 part IV: Want to improve student success? Start by improving introductory courses. Retrieved from https://www.forbes.com/sites/michaeltnietzel/2020/02/06/college-initiatives-for-2020-part-iv-transforming-the-large-introductory-course/#22e08e8020c2

Owen, D., & Vista A. (2017, November 15). Strategies for teaching metacognition in classrooms [Blog post]. Retrieved from https://www.brookings.edu/blog/education-plus-development/ 2017/11/15/ strategies-for-teaching-metacognition-in-classrooms/

Patrick, H., Kaplan, A., & Ryan, A. M. (2011). Positive classroom motivational environments: Convergence between mastery goal structure and classroom social climate. *Journal of Educational Psychology, 103*(2), 367-382. doi: 10.1037/A0023311

Popping, R. (2015). Analyzing open-ended questions by means of text analysis procedures. *Bulletin of Sociological Methodology*, *128*(1), 23 – 39. doi: 10.1177/0759106315597389

Reeve, J., & Hang, H. (2006). What teachers say and do to support students' autonomy during a learning activity. Journal of Educational Psychology, 98(1), 209 – 218. doi: 10.1037/0022-0663.98.1.209

Reynolds, A. L., Sneva, J. N., Beehler, G. P. (2010). The influence of racism-related stress on the academic motivation of black and latino/a students. *Journal of College Student Development*, *51*(2) 135 – 149. doi: 10.1353/csd.0.0120

Ryan, R. M. & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. New York, NY: The Guildford Press.

Schak et al., (2017). *Developmental education: Challenges and strategies for reform*. *U.S. Department of Education*. Retrieved from https://www2.ed.gov/about/offices/list/opepd/ education-strategies.pdf

Skaalvik, E. M., Federici, R. A., & Klassen, R. M. (2015). Mathematics achievement and self-efficacy: Relations with motivation for mathematics. *International Journal of Educational Research*, *72*, 129 – 136. doi: 10.1016/j.ijer.2015.06.008

Steltenpohl, P. J. (2012). *The relationship among math attitudes, learning strategies and resources used leading to successful completion of online mathematics courses in a two year technical college*. (Doctoral dissertation). Retrieved from http://www2.uwstout.edu/ content/lib/thesis/ 2012/2012 steltenpohlp.pdf

Thomas, D. (2003). *A general inductive approach for qualitative data analysis*. Auckland, New Zealand. School of Population Health, University of Auckland. http://www.frankumstein.com/PDF/Psychology/Inductive%20Content%20Analysis.pdf

Twigg, C. A. (2011). The math emporium: Higher education's silver bullet. *Change: The Magazine of Higher Learning*, *43*(3), 25 – 34.

Twigg, C. A. (2015). Improving learning and reducing Costs: Fifteen years of course description, *Change: The Magazine of Higher Learning*, *47*(6), 6 – 13. doi: 10.1080/00091383.2015.1089753

Williams, S. P. (2016). *Math emporium model: Preparing developmental students for college algebra*. (Doctoral dissertation). Retrieved from http://aquila.usm.edu/dissertations/417

Wood, J. L. (2014). Apprehension to engagement in the classroom: Perceptions of black males in the community college. International Journal of Qualitative Studies in Education, *27*(6), 785 – 800. doi: 10.1080/09518398.2014.901575.