Application of the Transformation through Dynamic Interconnectivity Model

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Abstract

The original conceptual model of MathWorld, a math support program at St. Philip's College, represented the researcher's hypothesis of this program before conducting the study. Additionally, the model was a way of organizing the types of skills (hard, soft, critical thinking, and confidence/self-efficacy) in which the math support specialists and math faculty can assist students. Upon completion of the data collection and analysis, however, the researcher discovered that the original model needed adjusting. MathWorld's reconceptualized model makes reference to emotional support and places emphasis on the activities connected to the aforementioned skills.

The Transformation through Dynamic Interconnectivity (TDI) model is similar to the Reconceptualization of MathWorld's model because it encompasses: (a) the same core practices (cultivating content-specific skills, supporting life skills, and providing holistic interventions), (b) the same categories of skills (hard, soft, critical thinking, confidence-building, and emotional support), and (c) the same characteristics of the core practices (processing information, demonstration, and connection). However, the integration of the aforementioned components creates the secret sauce of transformation through dynamic interconnectivity, which can be applied to a variety of subject areas, professional settings, and personal situations.

The following sections provide an example of how the TDI Model can be utilized in the following settings: (a) subject area, (b) professional, and (c) personal. For each example, the supporting role players, in addition to the characteristics of each core practice, are identified. While this study specifically addressed developmental math, the core practices of the conceptual model are not limited to this subject area. Although this study comprised a community college, the core practices of the conceptual model are not limited to an educational setting. Whereas this study included lived experiences in a public location, the core practices of the conceptual model can also be practical in personal arenas.

Keywords: *transformation, dynamic interconnectivity, MathWorld, TDI Model, integration, education.*

Introduction

This article emerged from the 2018 dissertation research conducted to explore the impact of participation in MathWorld on student success in developmental math courses. MathWorld, a math support program at St. Philip's College, is designed to assist students with study skills and gaining understanding of math concepts [5]. Utilizing the five steps to data analysis and representation [2], in addition to one-on-one interviews with participants, a follow-up survey, student testimonials, and the principal investigator's lived experiences, produced results that indicated how MathWorld uniquely contributes to student success in developmental math courses. The conceptual model of MathWorld is interactive in nature, because it requires participation from students, math faculty and MathWorld staff. The integration of all three components—cultivating content-specific skills, supporting life skills, and providing holistic interventions—make up the *secret sauce* of MathWorld. In this context, the phrase *secret sauce* is used to describe the important core practices that have a lasting, positive effect on student performance in math. The researcher linked these core practices into a conceptual model of success for developmental math students.

Based on the dissertation titled *Map of MathWorld: Identifying Core Practices for Successful Supplemental Instruction of Community College Students,* this article explains the researcher's original conceptual model of MathWorld, the reconceptualization of the MathWorld Model, the discovery of the Transformation through Dynamic Interconnectivity Model, and its application in a various situations. The issue now is the development of a theory to explain learner dynamics in developmental contexts.

Original Conceptual Model of MathWorld

The visual representation of the originally conceived model shown in Figure 1 is meant to be read from bottom to top. It appears as a figure of a house, which suggests that at the bottom the house, there is a foundation. In the context of this study, the researcher believed that the developmental math courses serve as the foundation. Many of the students who attend St. Philip's College take developmental math courses because, at the onset of their college career, their math skills are not sufficient to be successful at the college level. Successful completion of at least one college-level math course is one of the graduation requirements in obtaining any degree. However, there is something that needs to happen between the foundation (developmental math classes) and the ultimate goal (success in college-level math).

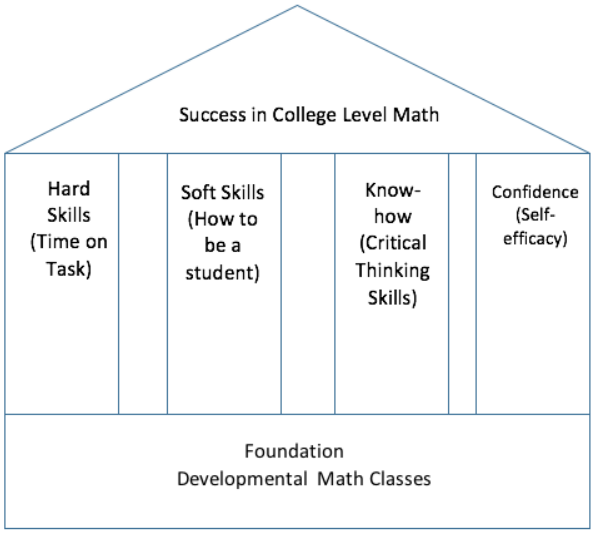

Figure 1. Original conceptual model of MathWorld, courtesy of Renita Mitchell.

While developmental math classes provide a foundation for students to learn, understand, and master the math concepts necessary for college-level math courses, they are not solely the important elements that play a critical role in student success in college-level math courses. Also, the developmental math courses do not always provide maximum flexibility of time and space for customized attention in addressing study skills (such as becoming better problem solvers). MathWorld, however, is a math support program that provides four pillars of support in tandem with the developmental education courses. These four supporting elements are: hard skills, soft skills, critical thinking skills, and self-efficacy [5].

Hard skills are skills which can be taught, such as reading, math, and writing. Soft skills include how to study, how to do homework, and how to manage time. Critical thinking skills consist of trouble-shooting, recognizing mistakes based on common sense, and applying problem-solving skills. Finally, self-efficacy deals with improving students' beliefs in their math abilities and helping other students [5].

Reconceptualization of the MathWorld Model

The researcher's originally conceived model, which was intended to illustrate the workings of MathWorld, was not an accurate representation. Instead, MathWorld's conceptual model necessitates active engagement from students, Bobs, and math faculty. To elaborate, Bobs are math support specialists named after Dr. Robert "Bob" Walling, a former coordinator of MathWorld. All Bobs represent a wide demographic population with regard to age, gender, ethnicity, and private and public sector experience. Additionally, they have a Bachelor of Science degree or higher in mathematics or a related field, such as accounting, engineering, physics, business, biology, and chemistry [5].

Three themes emerged from the researcher's analysis: (a) cultivating content-specific skills, (b) supporting life skills, and (c) providing holistic interventions (Figure 2). The reconceptualization of MathWorld's model is visually represented as three circles with connecting lines. Each circle in Figure 2 signifies core practices used by the Bobs and math faculty. The lines connecting each circle denotes the characteristics of these core practices [5].

Cultivating content-specific skills is a core practice by which the Bobs and instructors guide students to a better understanding of various math subjects. Supporting life skills is a core practice by which the Bobs and instructors create an atmosphere of relatability and gauging the socioemotional well-being of the students. Providing holistic interventions is a core practice by which the Bobs and instructors discern the students' academic and socioemotional needs and utilize appropriate interventions. The integration of these core practices, which represents the *secret sauce* of MathWorld, in addition to its characteristics, yield success [5].

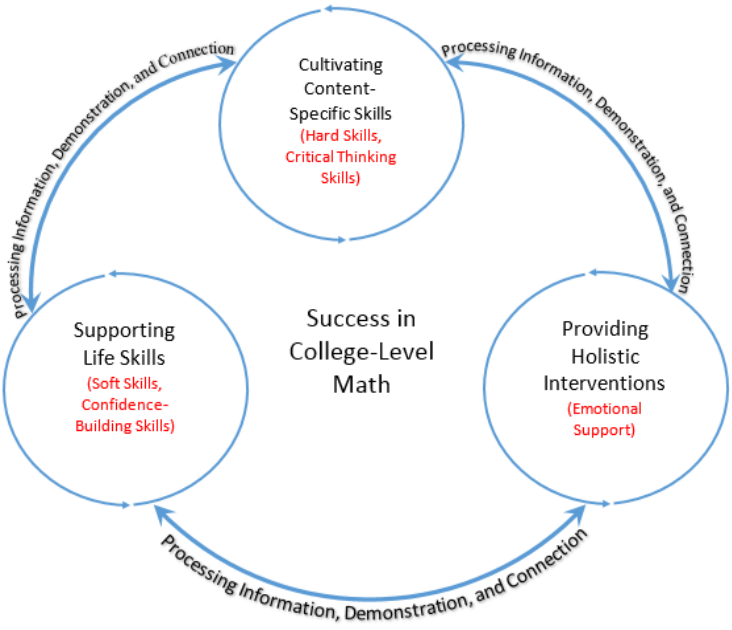

Figure 2. Reconceptualization of the MathWorld model.

The aforementioned original conceptual model of MathWorld (Figure 1) represented the researcher's hypothesis of this math support program before conducting the study. The "house" diagram, courtesy of Renita Mitchell, illustrates a visual representation of the original conceptual model [5]. As previously stated, developmental math classes provide a foundation for students to learn, understand, and master the math concepts necessary for college-level math courses; they are not solely the important elements that play a critical role in student success in college-level math courses. However, these classes do not serve as a starting point for students. The researcher proposed that students' prior knowledge of math, in addition to their personal and professional experiences, serve as the foundation. For many students who enter college and enroll in developmental math courses, in particular, this foundation may not be steady or secure enough to sustain them through their college experience. Consequently, students' background knowledge of math can be characterized as a rocky road; the potholes in the road represent students' gaps of knowledge. In this manner, a layer of concrete, which is symbolic of developmental math courses, must be applied to this foundation to provide more stability. Although developmental math courses have potential to fill in the necessary gaps to the students' knowledge base, these courses do not always provide maximum flexibility of time and space for customized attention in addressing study skills (such as becoming better problem solvers). MathWorld, however, is a math support program that provides pillars of support in tandem with the developmental education courses [5].

A New Model: Transformation through Dynamic Interconnectivity

While the researcher expected to discover the *secret sauce*, she realized that the *secret sauce* could apply to any situation that involved the development of students' educational skills and competencies while students had socioeconomic factors that impacted their learning. As shown in Figure 3, the Transformation through Dynamic Interconnectivity Model is visually represented as three circles with connecting lines. Each circle in Figure 3 signifies the core practices used by the supporting role players in a given situation. The lines connecting each circle denotes the characteristics of these core practices. The integration of these core practices, in addition to its characteristics, yield transformation [5].

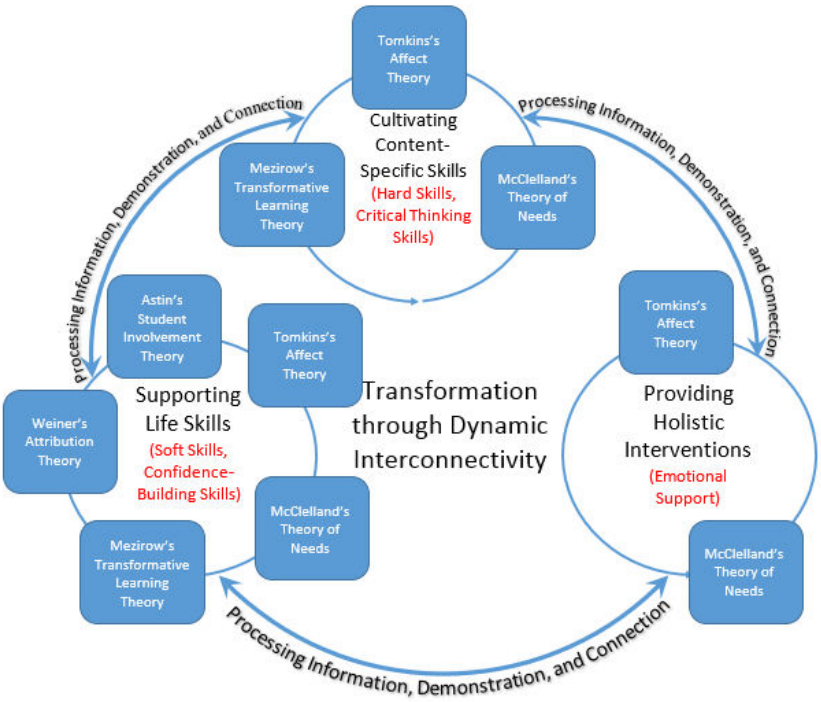

Figure 3. Transformation through Dynamic Interconnectivity model.

Application of the TDI Model

The Transformation through Dynamic Interconnectivity (TDI) model is similar to the Reconceptualization of MathWorld's model (Figure 2) because it encompasses: (a) the same core practices, (b) the same categories of skills, and (c) the same characteristics of the core practices (processing information, demonstration, and connection). However, the integration of the aforementioned components creates the *secret sauce* of transformation through dynamic interconnectivity, which can be applied to a variety of subject areas, professional settings, and personal situations. The following sections provide an example of how the TDI Model can be utilized in the following settings: (a) subject area, (b) professional, and (c) personal. For each example, the supporting role players, in addition to the characteristics of each core practice, are identified [5].

Example 1: Subject area. While the study specifically addressed developmental math, the core practices of the conceptual model are not limited to this subject area. To illustrate, developmental English will be used. The developmental English instructors, support specialists, and tutors are the supportive role players for students taking development English courses. They cultivate content-specific skills by assessing students' knowledge of hard skills (e.g., grammar usage, functions of words, and sentence structure) and critical thinking skills (e.g., analysis of written work). They also support life skills, for example, by modeling how to do an oral presentation based on the students' written work. Because students need to have command of the English language, it is expected that they also have the capacity to express their thoughts in a logical, clear, and fluent manner. Some students need to muster the confidence needed to transfer what they are thinking into written form, and do so in such a way that it is clear and understandable to the reader. The emotional support also refers to accommodations and/or modifications for students with special needs. Given this, the supporting role players need to be aware and use appropriate strategies to facilitate students' needs [5].

Example 2: Professional. Although the study comprised a community college, the core practices of the conceptual model are not limited to an educational setting. To explain, professional development will be used. The supervisor, colleagues, and other content specialists are the supportive role players for employees. They cultivate content-specific skills by assessing employees' knowledge of hard skills specific to their field (e.g., use of technology, writing skills, and knowledge of content) and critical thinking would involve creating plans and programs that enhance the organization. The supportive role players also support life skills, for example, by modeling effective communication skills and time management. Employees, during their tenure in the organization, process a variety of

information regarding their duties and responsibilities of their positions. For some employees, the significance of their status in the organization might become overwhelming and affect their confidence levels. Taking this into consideration, it is necessary for the supportive role players to utilize appropriate methods to guide the employees to success for the betterment of the organization [5].

Example 3: Personal. Whereas the study included lived experiences in a public location, the core practices of the conceptual model can also be practical in personal arenas. To elaborate, patients in a substance abuse facility will be used. The physicians, counselors, and other licensed professionals at the facility are the supportive role players for patients. They cultivate content-specific skills by assessing the patients' knowledge of hard skills (e.g., adherence to program rules and expectations) and critical thinking skills (e.g., develop and implement a personal development plan for recovery). They also support life skills, for example, by modeling strategies to counteract the urge of the substance with productive thoughts and behaviors. At some point during their time in the facility, patients are processing information, such as identifying the root causes of their addiction. Patients also may be fully cognizant of how their addiction has negatively impacted their lives and their spheres of influence (e.g., family, friends, coworkers). Given the emotional/psychological nuances of each patient, it is imperative for the supporting role players to use appropriate connections and interventions. This may include intuitively listening to the patients' expressions of guilt or shame, and providing a safe environment for patients so they feel more confident and open to discuss their issues. Hence, whether the circumstances involve subject areas, professional environments, or personal situations, the TDI model can be applicable to any context [5].

Discussion

In Patterson's (2018) study, five theories [1] [3] [4] [6] [7] explained the dynamics in the core practices. However, this model of dynamic interconnectivity is not limited to its application in math. The model can apply to any educational, professional, or personal situation. Examples include on-the-job training, developmental reading, learning a second language, job rehabilitation for worker's compensation victims or disabled veterans, and re-entry programs for prisoners. Thus, the Transformation through Dynamic Interconnectivity Model [5] creates a new way of thinking about establishing and maintaining productive learner dynamics in developmental contexts.

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