An Evaluation of Perceptions Regarding Mentor Competencies for Technology-based Personalized Learning

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Abstract:
The use of technology-based learning systems to provide individualized instruction through tutoring for K-12 students is gaining increased attention, especially as a result of the COVID pandemic. We discuss the development of pedagogical components of Personalized Learning^2 (PL^2), a human mentoring online system that supports both mentors and students while improving student's math achievement. PL^2 uses AI-driven software to recommend custom resources and supports based on mentor input and student math learning data. This research focuses on developing a more efficient and research-based method of resource organization by creating a schema of mentoring competencies. A preliminary survey was completed by 18 PL^2 partner members (i.e., mentors or mentor supervisors) to best determine the most important skills perceived to be successful. The survey results ranked mentor skills according to the perceptions of partner members, which demonstrated *Engage and Motivate Students* as the most important skill, whereas *Understand Educational Policies and Norms* was perceived to be of least importance. These results also guided the creation of a preliminary super-competency scheme through the creation of SMART supports (Social-emotional, Math Content, Advocacy, Relationships, Technology). Such schematic recategorization of mentor super-competencies will improve mentor training and optimize their efficiency in helping students with particular barriers to learning (i.e. lack of motivation, low self-efficacy).

Keywords: personalized learning; technology-based learning; intelligent tutoring systems; mentoring; tutor training

Introduction

Effective tutoring can be a powerful tool to ensure that every child receives targeted and individualized attention and mentorship during and after school. There is vast inequality between students who can access tutoring and those who cannot with marginalized students having less access to quality tutoring (Kraft & Falken, 2021). Such disparity among access to instructional resources and social-emotional supports, widens the opportunity gap among marginalized, often Black, Latinx, and from lower socioeconomic families—a population less likely to develop mentor-like relationships with teachers (Ander et al., 2016). In the wake of COVID pandemic, there is an increased need for access to tutoring to address the opportunity gaps (Kraft & Falken, 2021). There are many recent studies aimed at addressing the high costs in effectively training mentors and limited tutor supply (Oreopoulos & Petronijevic, 2018; Kwakye & Kibort-Crocker, 2021). Through online tutoring and technology-enhanced learning systems, mentors can support many more mentees, subsequently decreasing the cost of offering personalized tutoring. There exists substantial research on the principles that make successful tutoring programs and the level of tutor experience that yields positive outcomes in students' learning (Hudson, 2016; Vlachopoulos et al., 2021); however, there is a need to connect existing research to emphasize training of specific skills or competencies to prepare effective mentors, especially for marginalized student populations (Klevan et al., 2020; Martin & Dowson, 2009). [*]Personalized Learning^2 is an online learning platform that combines human tutoring, customized training, and student EdTech data to improve mentor efficiency by connecting mentors to personalized resources.

Our research focuses on determining specific competencies of successful mentorship through surveying the perceptions of teachers, tutor supervisors, and program decision-makers. These competencies will be used to

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[*] http://personalizedlearning2.org/

develop a more efficient and research-based schema of resource organization within technology-enhanced learning systems for the purposes of providing efficient and effective support for mentors and students. In many contexts, the terminology around tutoring and mentoring is used interchangeably, however, for purposes of this work supporting all facets of mentoring (e.g., relationship building, supporting self-efficacy, attending to motivation) the term 'mentor' will be used throughout.

This study responds to the following *research questions:*

1) What competencies do mentors and mentor-supervisors consider most beneficial for successful mentoring?
2) Why do certain mentor competencies take precedence over others?
3) In what ways can prioritization of mentor competencies shape the technology-based personalized learning environment, similar to PL[2]?

Literature Review

Historically, the development of definite competencies related to mentoring and tutoring were designated for higher education and medical fields (i.e., nursing, medical school). Our goal is to connect the existing research findings about effective mentoring competencies in K-12 education to support mentors in their work with students from diverse backgrounds. There has been little to no research regarding perceptions of mentor supervisors and educational practitioners (i.e., mentors, teachers, instructional coaches) about effective mentorship and their related competencies. Wyre et al. (2016) assessed mentorship of undergraduate mentees by faculty in higher education as mentors as part of the Ronald E. McNair Program. They analyzed the importance of the degree of mentor skill using a 5-point Likert scale in the following areas: student vision, relationship emphasis, information emphasis, and undergraduate student awareness of graduate school. Correlation analysis determined the relationship between research-based mentor competencies and Ronald E. McNair Program goals and found a significant need for mentor competency assessment, competent mentors, and higher quality competency models. The need for quality mentors is increasing to meet the needs of programs and organizations. Sometimes, organizations focus on recruiting and gaining mentors and not on the quality of the mentoring (Wyre et al., 2016; Klevan et al., 2020).

Many have attempted to isolate effective qualities of successful mentorship. Hudson (2010) concluded positive mentor-mentee relationships are crucial to the student/mentee's success in learning. Mentors can play an important role in mentees' psychosocial development, as "mentoring relationships can be powerful and life-changing events in people's lives" (Hansman, 2003, p. 14). These relationships can build mutual trust and respect when mentors utilize personal attributes (e.g., attentive listening, humor, honest communication) to facilitate the mentoring process (Hudson, 2016).

The increased need for one-to-one tutoring to help remedy the increasing opportunity gap experienced by marginalized students, mentors are becoming "primary players" in the "teaching and learning process", particularly in an online setting (Vlachopoulos et al., 2021, p. 40). For this reason, mentors must display competency and tutoring attributes, in addition to content level knowledge both in-person and online. Vlachopoulos et al. (2021) concluded online mentors need the most support and training in the following areas (in order of importance): using communication tools effectively, using and evaluating the virtual platform, and how to enhance the interaction within a virtual environment.

The effective use of technology and competencies related to mentoring must be included in determining specific skills that encompass successful mentorship in today's society. Recent changes due to COVID pandemic have caused a nationwide shortage of qualified teachers and mentors (Rosenberg et al., 2021). As more students and schools have begun using virtual learning platforms for teaching and learning, evidence shows virtual mentor training as effective as tutoring in an online environment (Robinson et al., 2021). Mentor training via online platforms can be useful to assist in building mentor capacities and improve their decision making with recommended resources, track learning progress, as well as provide insights to mentors about student learning.

Personalized Learning[2] Platform

Personalized Learning[2] is a learning platform that combines student educational technology, or EdTech, data with artificial intelligence (AI)-powered software to recommend customized resources for mentors and students (Schaldenbrand et al., 2021). Also known as PL[2], this state-of-the-art platform addresses the opportunity gap among marginalized students by syncing with students' existing math learning and providing mentors with personalized recommendations based on the student's individual math effort and progress goals. Mentors make post-session

reflections within PL^2 based on measured student motivation, effort, and progress. The system takes in all of these data streams and suggests resources to address the specific challenges of individual students. The PL^2 system tracks student and mentor progress as well as assigns training and resources to mentors.

Methods and Results

This study intends to develop an efficient and effective schema of mentor competencies for a technology-based training system. This paper presents the ongoing process of optimization and recategorization of mentor learning resources on the PL^2 mentoring platform. We take results from an ongoing survey data analysis given to the partners working in the partner organization. Our goal with this survey was to take an initial account of partners' perceptions about mentor competencies. A 4-point modified Likert scale was used with respondents rating each of the 13 competencies based on how important they felt the skill, ability, or behavior was for successful mentoring within their organization. The scale options for each randomized competency indicated with increasing importance were: [1] low priority, [2] medium priority, [3] high priority, [4] urgent. The survey suggested but did not require respondents to include at least two competencies of low priority to assist in disaggregating lower from higher mentor skills.

There were 18 survey respondents with most of them being organization administrators (6) with a breakdown of remaining leadership roles as follows: school principals (3) managers (3), trainers (3), and teaching staff (3). Respondents represented a variety of organization types: tutoring organizations (5), public school systems (4), educational support agencies (7), and college or universities (2). Table 1 summarizes the survey results of partner' perceptions about mentor competencies.

Table 1: Survey results on perceptions about mentor competencies in order of decreasing priority showing the average rating for each competency with [1] low priority to [4] urgent, or highest priority. *Engage and Motivate Students* received the highest rating (3.7) and *Understand Educational Policies and Norms* the lowest (2.2).

Mentor Competency	Rating
Engage and Motivate Students - A mentor needs to motivate students and keep them engaged.	3.7
Build Relationships with Students - A mentor needs to create strong relationships with students.	3.5
Foster Independent Learning - A mentor needs to enable students to take charge of their own learning and help students understand how to learn.	3.5
Demonstrate Awareness of Biases - A mentor needs to identify sources of bias, including any of their own, and to counter their effects.	3.5
Demonstrate Content Understanding - A mentor needs to have in-depth knowledge of the math content being taught and tools to support literacy.	3.4
Use Culturally Responsive Teaching Practices - A mentor needs to demonstrate awareness of and employ culturally responsive teaching practices to promote equity.	3.4
Apply Social-Emotional Learning Practices - A mentor needs to apply Social-Emotional Learning practices to support student's well-being and manage student emotions.	3.3
Manage Learning Environment - A mentor needs to create a suitable learning environment that supports the needs of each student.	3.1
Use Technology Effectively - A mentor needs to navigate technology to seek out the appropriate data, interpret it, and make decisions with it.	3.0
Practice Self-Care - A mentor needs to practice self-care and tend to their own mental and physical health, individually, and as a community.	2.9
Stay Organized - A mentor needs to efficiently manage their time and use available tools.	2.7
Communicate with Caregivers & Families - A mentor needs to successfully communicate with students' caregivers and family.	2.5
Understand Educational Policies and Norms - A mentor needs to know norms, trends, policies and the current state of education and how their work as mentors impacts that context	2.2

Research Question 1 & Research Question 2: The survey results determined *Engage and Motivate Students* (3.7) to be perceived as the most beneficial mentor competency for successful mentoring. This is not surprising given the abundant past research on the importance and impact of student motivation and engagement within the mentoring space on student achievement (Martin & Dowson, 2009; Noam et al., 2013). At a higher level, there are different kinds of engagement and motivation issues including short- and long-term versions of expectancy, value, and cost. It would be useful for mentor supervisors (and researchers) to gain a clearer perspective into which of these motivation issues are most frequent among students. Are students struggling most with interest in math? Or, perhaps, it is more nuanced with added student disinterest and frustration due to utility, self-efficacy, growth mindset, etc. (Martin & Dowson, 2009).

As the second most impactful competencies—*Build Relationships with Students*, *Foster Independent Learning*, and *Demonstrate Awareness of Bias* all received an average rating of 3.5. These findings on the importance of relationship building among mentors and students are consistent with the research signifying positive learning outcomes for students (DuBois et al., 2011; Hudson, 2016; Kupersmidt et al., 2017). The parallel significance between these competencies also points to the existing complexities within various contexts in which mentoring occurs and how these may influence forming productive relationships between mentors and mentees.

The lowest rated mentor competency indicating least importance was *Understanding Educational Policies and Norms* (2.2). Although this skill component was found to be of lesser priority than other competencies, this does not mean it is not valued in the mentoring space. In fact, the knowledge of local norms and policies assists with collaboration among program and school staff (TPP, 2020). More research needs to be conducted to determine if respondent roles in an organization impact their ratings on the importance of knowledge of educational norms and policies, including knowledge of math and other content standards.

Research Question 3: Additionally, prioritization of mentor competencies from survey results informed the recategorization of each competency into a schema through creation of SMART supports as mentor super-competencies (Social-emotional, Math content, Advocacy, Relationships, Technology tools). These mentor super-competencies or SMART supports represented main themes of mentor training and informed the improvement of learning experience and overall utility of resources on the PL^2 platform. Resources are organized within PL^2 according to competency with the goal of translating into the broader thematic super-competencies. Table 2 summarizes the key themes guiding the competencies and super-competencies results of the survey for all respondents. These point to the mentor role in promoting students' academic outcomes and their socio-emotional well-being through advocacy, increased content understanding, effective technology use, and developing mentor-mentee relationships. These themes of super-competencies align with the mentor attributes emphasized in the existing research (Hudson, 2016; Wyre et al. 2016).

Table 2: The key themes of super-competencies organized in the schema of SMART supports. The first parenthesis indicates the average priority rating from the survey. The second number in parenthesis (*indicated in italics*) is the current number of mentor resources located within the PL^2 app.

Social-Emotional	**M**ath Content	**A**dvocacy	**R**elationships	**T**echnology Tools
Support holistic development for all students	*Build content knowledge and understand standards and policies*	*Advocate for students and yourself*	*Nurture relationships with students and caregivers*	*Use technology effectively to be prepared and organized*
Engage and Motivate Students (3.7) *(32)*	Demonstrate Content Understanding (3.4)*(19)*	Demonstrate Awareness of Biases (3.5)*(0)*	Build Relationships with Students (3.5)*(7)*	Use Technology Effectively (3.0)*(17)*
Foster Independent Learning (3.5)*(3)*	Understand Educational Policies and Norms (2.2)*(5)*	Use Culturally Responsive Teaching Practices (3.4)*(9)*	Communicate with Caregivers (2.5)*(10)*	Stay Organized (2.7)*(0)*
Apply Social-Emotional Learning Practices (3.3)*(12)*		Practice Self-Care (2.9)*(0)*		

Researchers and developers of PL[2] system had anticipated *Engage and Motivate Students* as a higher ranked competency for successful mentoring, which directed their efforts to provide tutors with the largest number of resources related to this competency. Currently, the number of resources within the PL[2] library with 32 resources targeted for mentors (e.g., *Mindfulness to Improve Focus*, *Tips & Tricks to Maintaining Engagement)* and 19 students (e.g., *What Does It Mean to Have a Growth Mindset?*) respectively. Additionally, they had curated both scenario-based asynchronous activities (e.g., *How to Present the Lesson to Students: Framing Task Difficulty, Using Intrinsic and Extrinsic Motivation Strategies*) and in-person synchronous lessons (e.g., *Student Engagement & Motivation Strategies Using PL[2]*) for mentors. Although there are many PL[2] resources that facilitate *Engage and Motivate* competency, more training and specific resources related to utility value are needed. These resources would assist mentors with answering the following common question regarding math: "Why do I need to know this?" In addition, resources on the use of explicit motivation strategies, such as the use of incentives, positive behavioral interventions and support (PBIS), and rewards are warranted to give mentors a full range of support on student motivation and engagement.

Conclusion and Future Work

This study aims to optimize development of online tutoring and technology-enhanced learning systems to support training on a large scale, particularly new tutors and volunteers who work with students. With the recent changes in nationwide shortage of qualified teachers and mentors, virtual mentor training can be an effective solution for preparing trained mentors who can work consistently to provide personalized learning support to their mentees (Robinson et al., 2021; Rosenberg et al. 2021). This will assist marginalized students who otherwise would not have access to personal math mentors to receive math learning assistance. Our main goal is to address the opportunity gap for marginalized students by first, supporting tutors to promote students' learning effort and achievement—using AI to recommend what tutors can do and resources they can utilize to meet their students' learning needs based on their learning data. And second, by developing content and implementing an interactive instructional technique to assist tutors in expanding their knowledge, as well as new and volunteer tutors become effective math mentors.

In the future we plan to evaluate the usage of competencies related resources and address issues related to engagement and motivation including short- and long-term versions of expectancy-value, utility-value, and cost. We also plan to analyze the success of the PL[2] platform through asynchronous training performance (pre- to post instruction) gains to quantify mentor learning in the specific competency areas. One valuable resource could be a short survey that mentor supervisors could give to students to help determine what students feel when they are less engaged or unmotivated and why they feel that way. Overall, our research and development efforts in improving mentor skills through this online learning platform aim to ensure that every student can access individualized tutoring and learning support.

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