

Exploring the Impact of Mentoring on Mathematical Academic Performance and Sense of School Connectedness

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Abstract

The purpose of this research project was to examine how a consistent and established mentoring program impacts students' academic performance in elementary and middle school mathematics classes. Mentoring programs have been implemented in schools and communities to address socio-emotional, physical, and academic issues. Studies have shown that mentoring programs do have favorable effects in multiple facets of life and can have several benefits. However, some studies have also demonstrated no noted improvement due to a mentoring program specifically. Participants included students in third through eighth grade and were placed into one of two conditions: a control group who did not participate in mentoring and an intervention group who did engage in the mentoring activities. Students in third through eighth grade who engaged in one-on-one and group mentoring on a weekly basis. Results indicated that those who were in the intervention group outperformed those in the control group in a curriculum-based measure of mathematical academic performance. While preliminary, this study lends to the extant literature that supports the notion that mentoring, when targeted and specific, can provide bolstered support that positively impacts student learning.

Keywords: Mentoring, Middle School, Elementary School, Mathematics, Academic Performance.

I. Introduction

Despite different attempts in learning studying techniques, increasing motivation, and allocating more time, students continue to struggle with achieving exemplary academic performance. A mentoring program is meant to pair an adult with a child in the hopes of providing guidance, wisdom, sharing experiences all while developing a deep and meaningful relationship (Wilson, Polite, & Wilson, 2020). Mentoring programs generally have four main characteristics which include: the referral of students who can benefit from adult support by teachers, a weekly commitment for an extended period, one-to-one interaction, and engaging in a variety of activities with the intention of building strong relationships (Jucovy, 2000). Mentoring differs from tutoring. With a tutoring program, improved academic performance is expected because the sole function of a tutoring program is to improve an academic outcome. A tutoring program does not seek to build a trusting relationship. Rather, a tutoring program is simply meant to produce a favorable academic outcome through an intensive specified focus on a core subject or topic. Differently, a mentoring program seeks to build a deep impactful relationship with another human through building understanding and sharing personal socio-emotional facets of life as well. Therefore, any academic outcome from a mentoring program would not come as a direct consequence but rather as a byproduct of the

other outcomes occurring from a mentoring program (e.g., Hickman & Anderson, 2019).

Although the exact nature of the mentoring relationship varies from program to program, youth mentoring is generally defined as a consistent, prosocial relationship between an adult or older peer and one or more youth (Bayer, Grossman, & Dubois, 2015). Generally, the goal of mentoring programs is to provide youth with positive adult contact to 1) reduce risk factors for delinquency such as early antisocial behavior, alienation, family management problems, and lack of commitment to school; and 2) enhance protective factors, including healthy beliefs, opportunities for involvement, and social and material reinforcement for appropriate behavior (OJJDP, 1998). A mentoring program, in theory, can make all the difference for a struggling student to succeed academically and otherwise (e.g., Bayer, Grossman, & DuBois, 2015). The theory of instrumental mentoring emphasizes rapport, working alliance, mutual consent, regular contact, positive interaction, and a focus on the mentee. Mentoring programs that follow the instrumental theory do not necessarily emphasize the duration of the relationship or the closeness of the bond; rather the focus is typically on a goal directed activity or structured skill building experience that is specifically designed to target an outcome (e.g., McQuillin, Terry, Strait, & Smith, 2013). Thus, instrumental models of mentoring specify the mechanism of change as the skills and increased competence as opposed to the closeness of the bond or the endurance of the relationship (e.g., Nakkula & Harris, 2013).

Different mentoring programs can have different goals that are not necessarily focused on academic gains. Mentoring that has the goal of student attendance and increasing academic performance has a different structure and timeline than a mentoring program with a different goal, such as improving behavior. Non-specific, relationship-based approaches alone may not adequately address the substantial emotional, behavioral, or academic difficulties that mentees face. Compared to national samples, youth who are referred to mentoring programs are often at significantly higher risk for a variety of difficult life circumstances (e.g., poverty, parental substance abuse), as well as behavioral and mental health issues like depression, anxiety, aggression, and attention difficulties (Jarjoura et al. 2018). As a result, there are growing calls for programs to utilize the mentoring relationship as context for intentional, targeted skills development, in which mentors employ targeted skills designed to match the presenting concerns of mentees. This targeted approach contrasts with the historically dominant, non-specific friendship model, which holds that a supportive relational bond—alone—promotes positive developmental change.

Effects on Behavior, Connectedness, and Academic Achievement

Mentoring programs can influence behaviors in the academic context that can have an indirect effect on academic performance. For example, studies have shown that students who participated in mentoring programs had a lower number of school absences and discipline referrals (Gordon et. al, 2013). Additionally, students who participated in mentoring programs scored higher levels of connectedness on nine subscales on the Measure of Adolescent Connectedness. Connectedness is an important component of mentoring because the greater the quality of the relationship between mentor and mentee means that mentee will feel more connected to the people around them. These subscales of connectedness included connection with parents, friends, peers, and self in present and self in future. Students who are in their first year of a school-based mentoring program scored higher in connectedness than students who were not in the mentoring program. The group of 6th and 7th grade students, particularly, gained more support and development by the end of the program (Gordon et. al, 2013). The studies showed that the students who showed higher feelings of

connectedness with their mentor also reported higher levels of connectedness with other crucial relationships in their lives, such as with parents and teachers. The strengthening of these important relationships is what contributed to higher academic performance.

Youth Characteristics

Those who made the most improvement from the mentoring programs are the at-risk youth who had the most gains to make from these programs. These students were the ones who otherwise had the least support from other sources and had the least amount of resources available to them (Jekielek, 2002). In general, mentoring programs can help to prevent substance abuse in at-risk youth and can help reduce some, but not all, negative behaviors. These negative behaviors can range from stolen or damaged property to being involved in fights. (Jekielek, 2002).

Extant Research on Mentoring

Extant research has provided inconclusive evidence on the effectiveness of mentoring programs on youth outcomes (e.g., Bruce & Bridgeland, 2014). Those programs that have demonstrated significance, however, share some characteristics. The duration of the mentoring program plays an important role in how effective the program is. The more time spent in a mentoring program, the better the outcome. Also, the more frequently a mentor maintains contact with a mentee, the more effective a mentoring program. If mentors also made an effort to get to know the families of the mentees, they were more likely to have positive gains from the program (Jekielek, 2002). When mentees believed their relationships with their mentors were of a high quality, they were also likely to get better results from the mentoring program. Mentoring programs that were structured and provided quality interaction between mentor and mentee have the better chance of meeting youth needs and getting better results for the youth (Jekielek, 2002). Schools that make mentoring a core element of their institutions have more favorable outcomes. Also, when mentors are trained in mentoring, there are more positive results from the program (Eby et al., 2008). Findings from other research suggest that mentoring programs are similarly effective even when mentoring programs have different goals. Mentoring programs that had behavioral and academic were equally as effective as mentoring programs that focused on attitude and psychosocial development (Karcher et. al., 2002).

Although there are benefits to a mentoring program, there are some potential drawbacks that can hinder schools from implementing these programs in their school. One drawback is that mentoring programs may be more suitable for elementary schools to implement due to the variable course schedule in middle and high school students (Jucovy, 2002). Elementary schools typically have classrooms where the same group of students is with the same teacher for a majority of the day. This schedule setup can make it easier to manage mentoring sessions.

Another limitation of mentoring programs is that they may not be able to provide wisdom in a range of experiences. Mentoring programs may not be able to provide guidance on career exploration or activities beyond the experience level of the mentor (Jucovy, 2000). One other drawback of mentoring programs is that they may not be able to pair a child with a mentor for an extended period of time. This may be due to a change in the student's life or the limited availability of an adult due to his or her own personal schedules (Jucovy, 2000). There is also an additional drawback where the relationship built in a school-based mentoring program may not have the same level of depth because it is based on a rigid structure (Jucovy, 2000). While the profession of education has some evidence from mentoring literature regarding attendance, connectedness, and social emotional skills (e.g., Wilson, Polite, & Wilson, 2020),

what extant literature is missing is an examination of how a targeted, structured mentoring program might impact students' academic performance in a specific discipline. This study sought to address the following research question: Does a structured and consistent mentoring program positively impact the academic performance of the student?

II. Methodology

This quasi-experimental, mixed methods study explored the impact of weekly one-on-one and small group mentoring sessions had on the mathematical academic performance in elementary and middle school students.

Participants

Participants were students in third through eighth grade attending a K-8 school in an urban district. Students were assigned to either a control condition (n=50) where no mentoring took place or an intervention condition (n=52) and participated in weekly one-on-one and small group sessions.

Participants were equally representative of grade level, gender, and no students in either condition was being served through special education services. This K-8 school reports that 55% of the students are considered economically disadvantaged (i.e., qualify for free or reduced lunch). Table 1 provides an overview of the participants, by condition.

Table 1: Frequency Distribution of Participant Characteristics

Characteristic	Control (N=50)	Intervention (N=52)
Grade Level	3rd: 14%	3rd: 17%
	4th: 16%	4th: 20%
	5th: 16%	5th: 15%
	6th: 18%	6th: 15%
	7th: 18%	7th: 14%
	8th: 18%	8th: 19%
Gender	Male: 60%	Male: 58%
	Female: 40%	Female: 42%
Special Education	0%	0%

Procedure

Following parent consent and student assent, participants completed a baseline, curriculum-based measure of mathematical academic performance. Additionally, participants completed the Sense of School Connectedness Survey (adapted from Brew, Beatty, & Watt, 2004) at the beginning of the school year and again at the end of semester. The survey is on a 4-point scale (4=strongly agree 3=agree 2=disagree 1=strongly disagree) and yields scores associated with teacher support, belonging with peers, fairness and safety, academic engagement, relatedness, and engagement with community.

For those in the intervention condition, one-on-one mentoring sessions occurred once a week with each student on a designated day of the week at the school. Additionally, small group sessions were held once a week, with group composition being balanced for age and gender (group size was 4-5 students).. The duration of each mentoring session was approximately 10-20 minutes and the intervention lasted eight weeks. The agenda of each mentoring session consisted of (1) student reflection, (2) formation of short- term and long-term goals, and (3) determining a plan of action.

Following completion of the intervention, all participants completed the mathematical academic performance measure and the survey on school connectedness.

Results

To examine the effects of the mentoring intervention, several analyses were completed. First, descriptive statistics are reported for student scores on the mathematical academic performance assessment and the school connectedness survey, by condition. Tables 2 and 3 provides these data.

Table 2: Descriptive Statistics: Mathematical Assessment

Condition	Baseline	Post-Intervention
Intervention (n=52)	M=71.5 SD=3.6	M=82.8 SD=2.9
Control (n=-50)	M=72.3 SD=3.1	M=78.2 SD=3.2

Note. Assessment had a total of 100 points possible.

Table 3: Descriptive Statistics: School Connectedness Survey

Condition	Category	Baseline	Post-Intervention
Intervention (n=52)	Teacher Support	M=2.1 SD=0.91	M=3.2 SD=0.88
	Belonging with Peers	M=1.9 SD=1.1	M=2.9 SD=1.2
	Fairness & Safety	M=2.3 SD=0.72	M=2.8 SD=1.1
	Academic Engagement	M=1.7 SD=0.93	M=3.1 SD=1.0
	Relatedness	M=2.2 SD=1.0	M=3.4 SD=1.3
Control (n=-50)	Engagement with Community	M=1.6 SD=1.2	M=3.1 SD=0.76
	Teacher Support	M=2.3 SD=0.89	M=2.7 SD=1.1
	Belonging with Peers	M=2.0 SD=0.92	M=2.2 SD=1.0
	Fairness & Safety	M=2.2 SD=1.1	M=2.3 SD=0.82
	Academic Engagement	M=1.9 SD=0.89	M=2.4 SD=1.2
	Relatedness	M=1.8 SD=1.2	M=2.7 SD=1.0
	Engagement with Community	M=2.1 SD=0.90	M=2.6 SD=1.1

Note. Survey has a 4-point scale for each category.

There were no statistical differences between the two groups (i.e., intervention and control) at baseline. To determine if the intervention statistically improved mathematical academic performance and/or students' sense of school connectedness, t tests were computed on for the two variables. Regarding the mathematical performance variable, results indicated that those in the intervention group outperformed those in the control group on the assessment of mathematical academic performance. The 52 students who participated in the mentoring intervention (M=82.8, SD=2.9) compared to the 50 students in the control group (M=78.2, SD=3.2) demonstrated better mathematical academic performance, $t(100) = 7.61, p < .001$.

Regarding sense of school connectedness, results indicated that those in the intervention group responded more favorably on all survey categories. The 52 students who participated in the mentoring intervention (M=3.2, SD=0.88) compared to the 50 students in the control group (M=2.7, SD=1.1) reported a greater sense of teacher support $t(100) = 2.54, p < .05$. The students who participated in the mentoring intervention (M=2.9, SD=1.2) compared to the students in the control group (M=2.2, SD=1.0) reported a greater sense of belonging with peers, $t(100) = 3.19, p < .01$. The students who participated in the mentoring intervention (M=2.8, SD=1.1) compared to the students in the control group (M=2.3, SD=0.82) reported a greater sense of fairness and safety at school, $t(100) = 2.59, p < .01$. The students who participated in the mentoring intervention (M=3.1, SD=1.0) compared to the students in the control group (M=2.4, SD=1.2) reported a greater sense of academic engagement, $t(100) = 3.21, p < .01$. The students who participated in the mentoring intervention (M=3.4, SD=1.3)

compared to the students in the control group ($M=2.7$, $SD=1.0$) reported a greater sense of relatedness at school, $t(100) = 3.04$, $p < .01$. Finally, the students who participated in the mentoring intervention ($M=3.1$, $SD=0.76$) compared to the students in the control group ($M=2.6$, $SD=1.1$) reported a greater sense of fairness and safety at school, $t(100) = 2.68$, $p < .01$.

III. Discussion

Based on the results of the study, there appear to be benefits and to structured, school-based mentoring on students' mathematical academic performance and their sense of school connectedness. These findings lend support to extant literature indicating that mentoring can have positive impacts on students (e.g., Gordon, Downey, & Bangert, 2013; Wilson, Polite, & Wilson, 2020). However, further research needs to be implemented to explore the impact of a mentoring program more deeply in schools focused on improving academic performance.

Some limitations of the study include the small population size, short time span for intervention implementation, and inability to assess the long-term effects of the mentoring program. The population size in this study was relatively small and limits generalizability. An additional limitation of this study is the limited time constraint during which the study was constructed. The mentoring program took place over the span of a semester. The shorter time frame may attenuate the impact of the mentoring program. Some literature suggests that an effective mentor-mentee relationship needs a longer time frame to help the relationship develop and grow (e.g., Bayer, Grossman, & Dubois, 2015). A well-developed mentor-mentee relationship might yield different results. A final limitation of this study is the inability to understand the long-term effects of mentoring on the students with their academic performance. Some of the positive academic outcomes may be attributed to an effective mentoring experience, but these may be short-term effects. Further research can address whether a short-term mentoring program has long-term benefits or whether mentoring is beneficial only during the duration of the program. A mentor-mentee relationship may also be more beneficial to specific populations, such as at-risk youth, youth with mental health concerns, and youth that do not have other positive role models. These factors were not considered within the parameters of this study. However, these factors are necessary to consider when implementing mentoring programs.

Overall, the results showed that a structured and consistent mentoring program does positively impact the academic performance of the student within the discipline of math. Additionally, the mentoring intervention also positively impacted students' sense of school connectedness. Based on these findings, mentoring programs are shown to be beneficial in creating positive student-adult relationships and increase academic performance due to encouragement by the mentor, setting and creating goals with a mentor, and building a positive relationship with a mentor.

References

- Bayer, A., Grossman, J. B., & DuBois, D. L. (2015). Using volunteer mentors to improve the academic outcomes of underserved students: The role of relationships. *Journal of Community Psychology*, 43(4), 408–429. <https://doi.org/10.1002/jcop.21693>
- Brew, C., Beatty, B., & Watt, A. (November 2004). Measuring students' sense of connectedness with school. Annual meeting of the Australian Association for Research in Education, Melbourne, Australia.
- Bruce, M., & Bridgeland, J.M. (2014). *The Mentoring Effect: Young People's Perspectives*

on the Outcomes and Availability of Mentoring. A Report for Mentor: The National Mentoring Partnership.

- Eby, L. T., Allen, T., Evans, S., Ng, T., & DuBois, D. (2008). Does mentoring matter? A multidisciplinary meta-analysis comparing mentored and non-mentored individuals. *Journal of Vocational Behavior*, 72, 254-267. Doi:10.1016/j.jvb.2007.04.005.
- Goldner, L., & Ben-Eliyahu, A. (2021). Unpacking Community-Based Youth Mentoring Relationships: An Integrative Review. *International Journal of Environmental Research and Public Health*, 18(11), 5666. MDPI AG. Retrieved from <http://dx.doi.org/10.3390/ijerph18115666>
- Gordon, J., Downey, J., Bangert, A. (2013) Effects of a school-based mentoring program on school behavior and measures of adolescent connectedness. *School Community Journal* 23 (2). Retrieved from <https://files.eric.ed.gov/fulltext/EJ1028864.pdf>
- Hickman, G., & Anderson, S. (2019). The perceived impact of educational management organization mentors among high school dropouts who subsequently graduated high school. *Journal of At-Risk Issues*, 22, 1-8.
- Jarjoura, G. R., Tanyu, M., Forbush, J., Herrera, C., & Keller, T. E. (2018). Evaluation of the mentoring enhancement demonstration program: technical report (Office of Justice Programs' National Criminal Justice Reference Service Document Number 252167).
- Jekielek, S. M., Moore, K., Hair, E., Scarupa, H. (2002). Mentoring: A promising strategy for youth development. *Child Trends Research Brief*, 2, 1-8.
- Jucovy, L. (2000). *The ABCs of school-based mentoring*. Philadelphia, PA: Public/ Private Ventures. Retrieved from <https://ppv.issuelab.org/resource/the-abcs-of-school-based-mentoring.html>.
- Karcher, M. J., Davis, C., Powell, B. (2002). The effects of developmental mentoring on connectedness and academic achievement. *The School Community Journal*, 12(2), 35-50.
- Nakkula, M. J., & Harris, J. T. (2013). Assessing mentoring relationships. In D. L. Dubois & M. J. Karcher (Eds.), *Handbook of youth mentoring* (2nd ed) (pp. 45– 62). Washington, DC: SAGE Inc.
- Office of Juvenile Justice and Delinquency Prevention [OJJDP]. (1998). *Juvenile mentoring program 1998: Report to Congress*. Washington, DC: U.S. Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention.
- Terry, J., Strait, G., McQuillin, S., & Smith, B. H. (2014). Dosage effects of motivational interviewing on middle-school students' academic performance: Randomized evaluation of one versus two sessions. *Advances in School Mental Health Promotion*, 7(1), 62–74. <https://doi.org/10.1080/1754730X.2013.851995>
- Wilson, K., Polite, W., Wilson, T. (2020). Exploring relations among self-efficacy, school connectedness, and self-regulation in at-risk elementary male students. *American Journal of Humanities and Social Science*, 7, 1-11.