

A Fixed Mindset in Mathematics

Brett McNabb

Abstract

There are many people whose actions and behaviours can influence the mindset and beliefs that students have toward learning math. In addition to other factors such as social media, which are beyond the scope of this article, parents, teachers, and peers all have different influences on children's mindsets, and often those people do not recognize when they are negatively affecting a student. Teachers need to think critically about their own lessons and assist parents and students to build the necessary skills to help these children build a growth mindset in math.

Children are not born thinking that they are good or bad at math. Children's mindsets can be influenced by other people in their lives, even with subtle messages and beliefs (King, 2020). The mindset of students can be influenced by their parents, their teachers, and their peers, all of whom lie somewhere on the mindset continuum from fixed to growth. Having a fixed mindset means believing that a person's intelligence cannot be changed, whereas having a growth mindset means believing that a person's intelligence can be changed (King, 2020). These mindsets may contribute to a student's academic performance, including interest and participation in mathematics.

Parental Influence

When parents give assistance in math to their children, the assistance can be counterproductive to the students' achievement if the parent reports high levels of math anxiety (DiStefano et al., 2020). When these parents project their own beliefs about mathematical abilities onto their own children, they may lead the children to believe that they are not math people, or that they were not born with a math brain (Miller, 2020). Parents can also influence their children's mindsets when assisting with the students' math homework. Teachers are expected to spend a lot of time within their classroom promoting growth within their students (DiStefano et al., 2020). If teachers work with parents who are anxious about math, in order to provide proper teaching strategies and how to build a growth mindset at home, teachers should see the benefits at school in academic achievement.

Students who receive academic assistance from parents have shown higher belief in their abilities and understanding of their academic self-concept (Zhou et al., 2020). The impact of parental involvement in children's academic success has a quality-over-quantity relation, such that how a parent assists in homework is more influential than the amount that they assist (Silinskas & Kikas, 2019). Parents may be involved in their children's learning, but if they are worried or anxious about the content, then the students can also be worried and anxious (DiStefano et al., 2020). Providing quality assistance in mathematics cannot be achieved if a parent does not model and reinforce discourse that promotes positive attitudes and behaviours. Teachers need to scaffold not only the math content, but also the emotional experience for parents (DiStefano et al., 2020). Teachers need to provide guidance on the content and on how to promote a growth mindset, in order to help parents to become comfortable when assisting their children with homework. With guidance from teachers, parents can learn how to model positive behaviours and feelings toward mathematics to their children.

The feelings and ideas that children pick up from their parents can negatively affect their learning and academic achievement (Parents' Beliefs, n.d.). Students' academic performance is

harmful more by the negative messages and perceived anxiety from parents than it is by their actual mathematical knowledge. As teachers, we need to encourage parents to acknowledge the work that the students have done, and not just the outcome (Boaler, n.d.). When parents have a growth mindset, they are more engaged in mathematics activities. Students whose parents have a fixed mindset have shown promising results when their parents begin to believe intelligence is not fixed (Rowe & Leech, 2018). Teachers need to find a way to make connections with parents so they can learn new ways to model behaviours and attitudes that will maximize building a growth mindset in their children.

Teachers have worried that their efforts in building a growth mindset can be undermined if parents praise only success and ignore failure, rather than praising the effort or the growth (Rienzo et al., 2015). When parents refer to children's success as being a result of the children being smart, then they are setting children up to believe that they are not smart when they fail (Boaler, n.d.). Parents often focus on the right and wrong of a problem. When the results of a task are classified as a success or a failure, students tend to make more mistakes and be more confused, but when students are given empathic responses to their work, they become more confident, patient, and interested students (Karumbaiah et al., 2017). If the only resource that parents receive from teachers is an answer key, then the parents will focus only on answers and not provide a learning environment that promotes growth and understanding.

As educators, we need to create more conversations about teaching math with parents and other outside observers. The notion that students are learning a new type of math builds anxiety and distrust among parents (Chernoff, 2019). When teachers work with parents to guide them through the homework, and provide the parents and students with more feedback, students show more affection toward learning (Zhou et al., 2020). Teachers are able to make these connections in different ways. One way is to scaffold any assigned homework and the instructions that go with it. Breaking down these instructions will help parents to build an understanding of the mathematical process. The instructions are for the actual mathematical tasks, but also for ways to model behaviours and provide questioning and feedback that help parents build a growth mindset in their children (DiStefano et al., 2020). Hosting an open house or a math night provides an opportunity for parents to view their children learning and to see the strategies that teachers use in class. At these in-person events, teachers model student problems or questioning techniques for parents to use at home (Kessinger, 2014). When parents view a teacher's strategies, they are able to be better involved in their children's homework (Zhou et al., 2020). It is important for teachers to open a line of communication with parents so that parents understand how to build a growth mindset in their children.

Teacher Influence

Teachers may influence the mindset of students by the way they provide feedback and praise to their students (Rienzo et al., 2015); thus, they may negatively influence their students' mindsets unknowingly. Teachers may believe that they are using the best practices to promote a growth mindset. However, there is often a disconnect between a teacher's belief in growth mindset and a teacher's practices to build it (Sun, 2019). Many teachers want to provide an environment that promotes a growth mindset, but they may deliver messages to students in ways that contradict their beliefs. For example, teachers may believe in growth mindset, but if they provide only standard algorithms and praise only grades rather than creativity and growth, then their actions are not aligned with their beliefs (Sun, 2019). It is critical that teachers reflect on their teaching practices, their assessments, their questioning, and their feedback in order to ensure that they are effectively building a growth mindset.

A teacher's feedback or praise may cause a change in the way students view their abilities and may shift their mathematical mindset. If a teacher is focused on the end result of an activity, then the students will build an impression that they are smart or that they are not smart (Rienzo et al., 2015), depending on the outcome of that activity. When students are praised for the

completed work and the process, they will build a sense of achievement or determination to succeed. When students are given feedback on a failed task in a learning-focused manner, students will begin to build a growth mindset (Sun, 2019). If teachers are going to turn their students' fixed mindsets into growth mindsets, they need to be consistent in their feedback and assessment over time, focusing on the process of learning rather than just right or wrong.

Teachers' beliefs in a growth mindset do not always lead to academic success and growth in their students. However, a teacher's belief in students' mathematical abilities is predictive of the belief that students have in their own mathematical abilities (Eccles & Jacob, 1986). Regardless of teachers' mathematical ability, they can still produce students who believe negative stereotypes around math, and produce students with fixed mindsets. Teachers of all mathematical abilities who are anxious about teaching math may model anxious behaviour around students or may focus strictly on rote learning techniques (DiStefano et al., 2020). If a teacher does not promote growth within a specific discipline (i.e. growth mindset in mathematics), students will not see connections between growth and mathematical achievement. Not promoting growth within the desired discipline may attribute to students building a fixed mindset, but in classrooms where growth mindset in mathematics is promoted throughout the year, students understand that growth is a process and that success is not measured by right or wrong answers (Sun, 2019). Implementing new strategies throughout the school year will help students to see that growth is longitudinal and that building a growth mindset takes time.

Teachers may not realize the contradictions between their teaching practices and their belief in growth mindset. Implementing new techniques and strategies can be difficult for some teachers who may find it easier to revert to their old teaching ways (Sun, 2019). Teachers and schools need to work together to provide effective feedback and praise at an early age for this strategy to be effective (Rienzo et al., 2015). Teachers need to continue to reinforce the idea of growth mindset and teach new skills and strategies throughout the year (Sun, 2019). If teachers introduce the idea of growth mindset to their students in the first week of school, they need to continue working toward the goal of having a growth mindset throughout the year. If teachers do not follow up with feedback or problems that enable students to build growth mindset over time, then the students will not grasp the concept or build the skills needed to succeed academically.

Peer Influence

As students age, they spend more time around their classmates and peers, which increases the influence that adolescents and teens have on each other. When students spend more time together, they may begin to identify more with their peers than with their teachers (King, 2020). Teachers may not be aware that mindsets are learned not only from adults, but they may also be contagious between peers). If students are not given the correct kind of praise from their peers, it creates behaviours that are defeating and will not motivate students (Zhang et al., 2020). When teachers are not aware of the influence that peers have on each others' mindsets, they may put students in situations where they are negatively influenced when learning.

Praise from peers is an effective tool once teachers have taught proper feedback skills and have promoted a growth mindset in their classroom (Strengthening Peer Reviews, 2019). Feedback that is focused on process over results improves students' mindset and, as a result, improves their motivation and belief in growth (Zhang et al., 2020). As teachers start to implement growth mindset practices in their classrooms, they should also implement peer feedback with their students. Process-focused feedback between peers can promote a growth mindset and increase academic motivation. If teachers develop the skills needed for peers to deliver positive feedback, students can foster the development of growth mindsets and become more motivated and academically successful learners.

Teachers need to build academic motivation within their students by promoting a growth mindset. When peer feedback praises the work and effort of a student, the tension between students and negative impacts of low-level achievers are reduced (Zhang et al., 2020). As when teaching basic mathematic lessons, teachers need to scaffold instructions for the skills needed to provide effective peer feedback. This may be done by modelling questions or feedback that students can use. Teachers need to provide environments for students to grow and to be motivated. Students should not give feedback on work by labeling it as right or wrong, but rather offer feedback focusing on the process of the work and the effort that is made.

Conclusion

Students' mindset and belief in academic achievement may be shifted by many different people in their lives. Parents and teachers who do not think about this may put students in a situation where they will develop fixed mindsets. Parents can create a negative learning environment by believing that math is an innate skill that some people have, and some do not. Teachers may believe in a growth mindset, but if they are not providing an environment to promote such a mindset their students may not strive for academic growth. When students align themselves with different friend groups, they can develop fixed mindsets and be unable to achieve mastery skills in math. All of these factors contribute to a student's mindset in their own way, and if teachers are unaware of these factors they cannot help a student to grow.

References

- Boaler, J. (n.d.). *Twelve steps to increase your child's math achievement and make math fun*. Youcubed. Retrieved October 17, 2020, from <https://www.youcubed.org/wp-content/uploads/2018/03/12-Steps-to-unlock-your-students-math-achievement.pdf>
- Chernoff, E. J. (2019) The Canadian math wars. *Canadian Journal of Science, Mathematics and Technology Education*, 19(1), 73-76. <https://doi.org/10.1007/s42330-018-0037-9>
- DiStefano, M., O'Brien, B., & Storozuk, A., Ramirez, G., Maloney, E. A. (2020). Exploring math anxious parents' emotional experience surrounding math homework-help. *International Journal of Educational Research*, 99, Article 101526. <https://doi.org/10.1016/j.ijer.2019.101526>
- Eccles, J. S., & Jacob, J. E. (1986). Social forces shape math attitudes and performances. *Signs*, 11(2), 367-380. <https://www.jstor.org/stable/3174058>
- Karumbaiah, S., Lizarralde, R., Alessio, D., Woolf, B., Arroyo, I., & Wixon, N. (2017). Addressing student behavior and affect with empathy and growth mindset. In *Proceedings of the 10th International Conference of Educational Data Mining* (pp. 96-103). files.eric.ed.gov/fulltext/ED596572.pdf
- Kessinger, S. (2014). Family game nights. *National Council of Teachers of Mathematics*, 21(3), 146-152. <https://doi.org/10.5951/teacchilmath.21.3.0146>
- King, R. B. (2020). Mindsets are contagious: The social contagion of implicit theories of intelligence among classmates. *British Journal of Educational Psychology*, 90(2), 349-363. <https://doi.org/10.1111/bjep.12285>
- Miller, S. (2020, January 31). *Math and the growth mindset*. LD at school. Retrieved November 2, 2020, from <https://www.ldatschool.ca/math-growth-mindset/>
- Parents' beliefs about math change their children's achievement*. (n.d.). Youcubed. Retrieved October 17, 2020, from <https://www.youcubed.org/resources/parents-beliefs-math-change-childrens-achievement/>
- Rienzo, C., Rolfe, H., & Wilkinson, D. (2015). *Changing mindsets: Evaluation report and executive summary*. Education Endowment Foundation.
- Rowe, M. L., & Leech, K. A. (2018). A parent intervention with a growth mindset approach improves children's early gesture and vocabulary development. *Developmental Science*,

- 22(4), Article e12792. <https://doi.org/10.1111/desc.12792>
- Silinskas, G., & Kikas, E. (2019). Parental involvement in math homework: Links to children's performance and motivation. *Scandinavian Journal of Educational Research*, 63(1), 17-37. <https://doi.org/10.1080/00313831.2017.1324901>
- Strengthening peer reviews through growth mindset*. (2019, November 19). Model teaching. Retrieved November 20, 2020, from <https://www.modelteaching.com/education-articles/gifted-talented/strengthening-peer-reviews-through-growth-mindset>
- Sun, K. L. (2019). The mindset disconnect in mathematics teaching: A qualitative analysis of classroom instruction. *Journal of Mathematic Behavior*, 56, Article 100706. <https://doi.org/10.1016/j.jmathb.2019.04.005>
- Zhang, J., Kuusisto, E., Nokelainen, P., & Tirri, K. (2020). Peer feedback reflects the mindset and academic motivation of learners. *Frontiers in Psychology*, 11, Article 1701. <https://doi.org/10.3389/fpsyg.2020.01701>
- Zhou, S., Zhou, W., & Traynor, A. (2020). Parent and teacher homework involvement and their associations with students' homework disaffection and mathematics achievement. *Learning and Individual Differences*, 77, Article 101780. <https://doi.org/10.1016/j.lindif.2019.101780>

About the Author

Brett McNabb teaches grades 8 and 9 in Waterhen, Manitoba. He is working toward his M.Ed. with a focus on curriculum and pedagogy. He has five years of teaching experience in northern Manitoba. Brett enjoys the outdoor activities that the north provides, such as fishing, hunting, and snowmobiling.