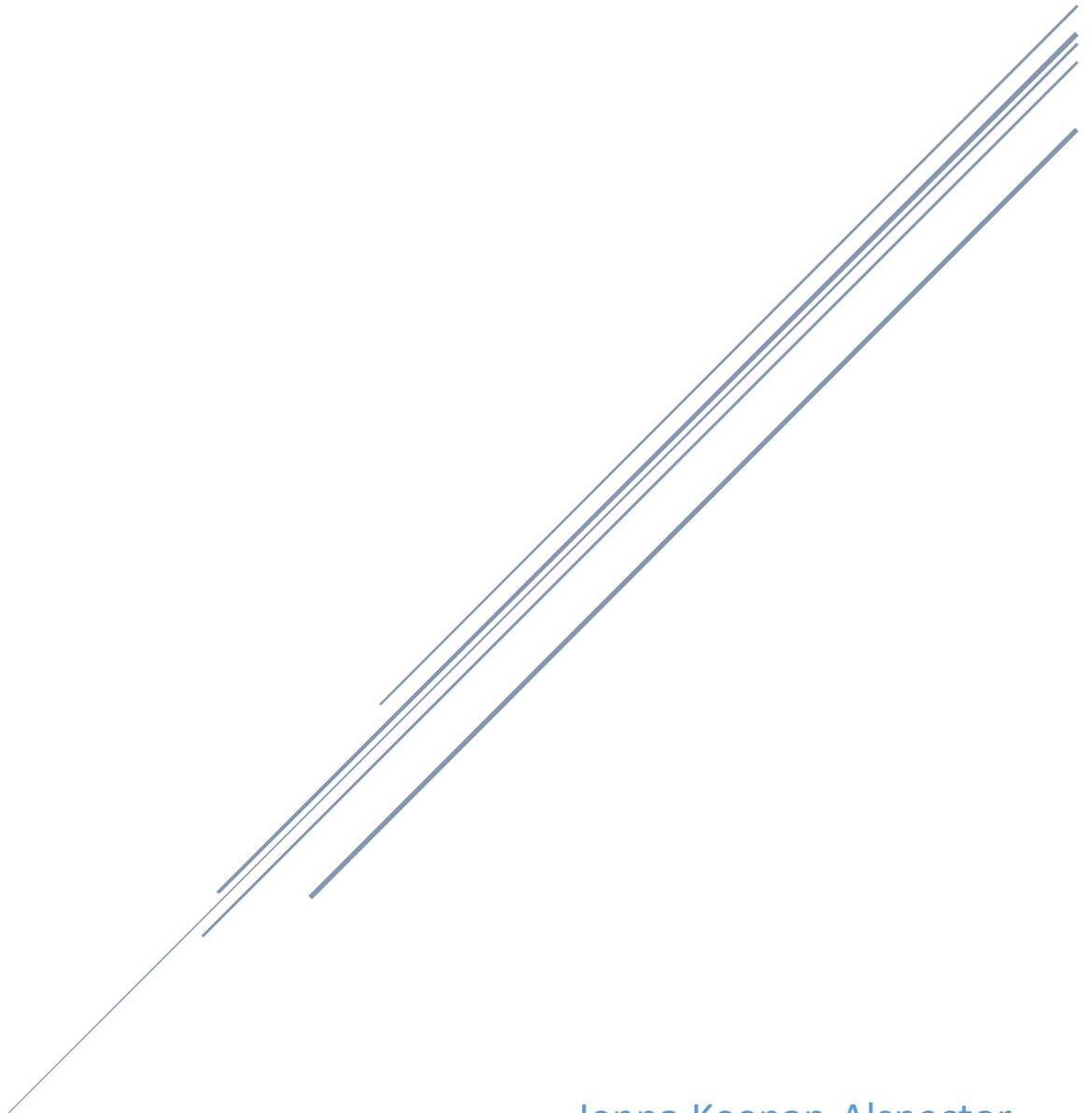


GROWTH MINDSET: THE PROBLEM SOLVER'S KEY TO SUCCESS



Jenna Keenan-Alspector
Course: Methods in Cognitive Science

Jenna Keenan-Alspector
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The mindset determines how we lead our lives: pushing the boundaries or living within them. Carol Dweck argues, in her book “Mindset: The New Psychology of Success”¹, there are only two mindsets: the fixed mindset and the growth mindset. Dweck’s thoughtful account of the power of the growth mindset sets a new precedent for the way success and failure should be defined and problems should be solved. She is able to prove throughout her book that the growth mindset is the key to success for all that employ it, whether it is by children, students, parents, teachers, coaches, bosses, employees, or the global development practitioner.

This paper is organized as follows: First, the major concepts will be defined and explored including the basic problem solving cycle, the fixed mindset versus the growth mindset, failure in the context of the mindset, metacognition, and persistence. Next, the paper will explore various studies suggesting the growth mindset is a necessity for effective problem solving. Finally, the paper will conclude by reviewing a case study of a development project failure and explore how a process needs to be in place to identify fixed mindsets and to encourage a growth mindset.

Concepts

Problem Solving

Problem solving is a complex web of trial and error. A great stride in the theory of problem solving was made when the problem solving cycle was defined with seven steps: (1) recognize or identify

¹ Dweck, C. (2006). *Mindset: The new psychology of success*. New York: Random House.

the problem; (2) define or represent the problem mentally; (3) develop a solution to the strategy; (4) organize knowledge about the problem; (5) allocate resources for solving the problem; (6) monitor progress toward the goal; and (7) evaluate the solution for accuracy.² The problem solving cycle as described above does not prescribe how to optimally approach these steps. It is especially important to consider the optimal approach when solving an ill-defined problem, a problem that lacks a clear path to a solution. The optimal approach will further explored by reviewing the growth mindset, metacognition, and persistence.

Fixed vs. Growth Mindset

Individuals attempting to problem solve or working towards a difficult task with a fixed mindset tend to quit before they fail. Those with fixed mindsets believe they should have the innate ability and skills to excel, outperforming peers with little effort. These individuals do not acknowledge all people begin from relatively the same starting point, without knowledge. The fixed mindset often takes credit for a group's great accomplishments, is intolerant of mistakes, and point fingers when mistakes are made without thinking about the team in general. This is the fixed mindset, the non-learner, at its most extreme.

An individual that employs the growth mindset is also referred to as the learner. The individuals with growth mindsets accept setbacks and failures when problem solving or working on difficult tasks because they understand missteps are lessons on the way to greater understanding. Individuals who have a growth mindset work hard to get what they want and do not assume it will

² Pretz, J.E., Naples, A.J., Sternberg, R.J. (2003). Recognizing, Defining, Representing Problems. *The Psychology of Problem Solving* (Chapter 1). Cambridge, UK ; New York : Cambridge University Press

be easy. The learners are fighters, encouragers, and team players. They look to learn from everyone around them and believe the collective group is stronger than the individual¹.

Failure

Often we hear “failure does not help towards solutions.” Belief in this ideology is only to be understood and experienced by those who have fixed mindsets. Fixed mindsets give up in the face of difficult problems they do not think they can solve, as a result they rarely fail the task since they do not complete the task. If they do fail, they run away; and the failure surely did not help towards the problem’s solution.

If instead one approaches problem solving with a growth mindset they will not shield themselves from failure but embrace the lessons learned. Individuals with growth mindsets reject the concept that “failure does not help towards solutions” because they find all failures and setbacks as an essential part of their success.

Metacognition

The term metacognition is directly translated to “thinking about thinking.” The practice of using metacognition combines many processes including: introspection, self-observation, self-monitoring, and self-reflection³. Metacognition has the power to help problem solvers overcome the most dangerous knowledge, the cognitive blind spot. The cognitive blind spot is the knowledge that one does not know they do not know⁴.

³ Jäkel, F., & Schreiber, C. (2013). Introspection in Problem Solving. *Journal of Problem Solving*, 6(1), 20-33.

⁴ Patterson, D., Sim, S., & Aiyelokun, T. (2009). Overcoming Blind Spots in Interaction Design: A Case Study in Designing for African AIDS Orphan Care Communities. *Information Technologies and International Development*, 5(4), 75-88.

Persistence

Persistence is a consequence of the metacognitive process. The ill-defined problem lacks problem definition and problem representation, as such there is the potential for many missteps². The problem solver practicing metacognition asks themselves questions about their approach and examines where they may be failing. To ask these questions one must be comfortable discovering they are going down the wrong path and must be comfortable iteratively working through the problem solving cycle. The metacognitive process requires the problem solver to be persistent, to keep trying, and have the motivation to keep searching for the correct solution(s).

Case Study One: Tower of Hanoi Test

Gary Fireman and Gary Kose were interested in the understanding the power of metacognition. They created a controlled experiment to determine if metacognition is an effective approach in problem solving by using the Tower of Hanoi Test⁵ with young children in multiple iterations. A diagram demonstrating the Tower of Hanoi Test is presented in Figure 1.

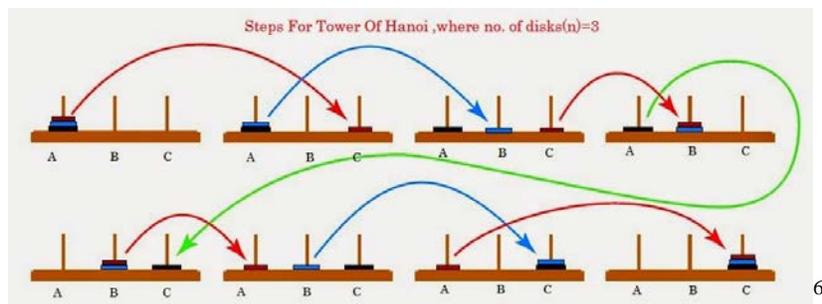


Figure 1 Three-Disc Tower of Hanoi Puzzle Answer Demonstrated

⁵ The Tower of Hanoi puzzle challenges the individual to move discs from a starting post to the final post in order of size with the added condition of never having a disc sit on another disc of smaller relative size.

⁶(n.d.). Retrieved March 1, 2015, from <http://2.bp.blogspot.com/-oecLHllokdw/U4rGQGLYxtI/AAAAAAAAA3E/dLsxPeluHN0/s1600/hanoi.jpg>

The research team selected 124 children in the first grade through third grade, ages six through eight. First, the students were given three minutes to solve the three-disc Tower of Hanoi problem, each student was video-taped during the initial three minute trial. One week later the students were split into four groups:

1. Model Condition: the model condition group was shown by an adult how to most effectively solve the puzzle.
2. Video Condition: the video condition group showed children the video of themselves working on the project from the first session.
3. Practice Condition: the practice condition group was not shown video playback of themselves or other children performing the task, nor were they given additional instruction. They were only provided with additional time to practice.
4. Control Condition: the control condition group received no further attention or practice time.

After the group sessions all of the children were instructed to try to solve the three-disc Tower of Hanoi puzzle in three minutes. After the three-disc Tower of Hanoi puzzle session ended the children were given a four-disc Tower of Hanoi puzzle and provided with four minutes to solve it. The conclusion of the test revealed the children who performed best when given the more difficult four-disc puzzle were those in the video condition group, followed by the practice group, model condition group, and lastly the control condition group.⁷

The results of the Tower of Hanoi experiment proves Fireman and Kose's hypothesis that metacognition is an effective method to use in the problem solving cycle. However, as I will

⁷ Fireman, G., & Kose, G. (2002). The Effect of Self-Observation on Children's Problem Solving. *Journal of Genetic Psychology*, 163(4), 410.

explore, these methods were not the only factors that affected performance in Fireman and Kose's test. The experiment also demonstrates the impact of the mindset.

The children in the video condition group and those in the practice condition group were more successful with solving the difficult four-disc puzzle. These two groups were placed in an environment that encouraged use of the growth mindset. The children in the video condition group were encouraged to think about their thinking by watching their previous attempt. Neither group experienced negative criticism. The video condition group performed the best because metacognition was forced and resulted in increased persistence.

Conversely, the children in the model condition group were coerced to thinking with a fixed mindset. The model condition group were shown how to complete the puzzle by an adult. These children were not encouraged to use their previous experience to solve the problem, instead they received the message: since they couldn't do it the first time, they failed. As Dweck discusses when individuals are in a fixed mindset they are disengaged and simply reread study material leading to non-learning; re-reading text has been proven to be the most ineffective method to learn⁸. The model condition group demonstrated this tendency, they became disengaged and did not learn how to solve the puzzle or learn how the logic to solve the puzzle worked. The fixed mindset used by the model condition group discouraged the children to persist in solving difficult problems in fear of failures.

This experiment shows that an individual employing a growth mindset is more likely to use metacognition to solve problems because they are inclined to reflect on their thought process. In other words, they keep an open mind and do not approach problems thinking they know the answer.

⁸ Brown, Peter C., Henry L. Roediger, III, and Mark A. McDaniel. (2014). *Make It Stick: The Science of Successful Learning*. Cambridge, MA. Harvard University Press

Additionally those with a growth mindset and metacognition are more likely to persist as they work through the problem solving cycle.

Case Study Two: Unskilled and Unaware Test

Dweck indicates individuals with the growth mindset do not let failures stop them from persisting and working towards improvement. Metacognition encourages persistence, and the combination of both helps problem solvers identify cognitive blind spots and excel past those blind spots.

The cognitive blind spot of low performers, their misunderstanding of their relative low performance, has been explored by researchers. These low performers have been coined as “unskilled and unaware”. A team of researchers, Mattern, K. D., Burrus, J., & Shaw, E., explored the unskilled and unaware phenomenon through the extended examination of students from their performance on the SAT through their college graduation rates. The goal of the study was to review the academic consequences of the change in low performers after they have been made aware of their relative standings by the SAT results, which were previously misunderstood.

The Unskilled and Unaware Test examined the progress of students first from their estimation of relative SAT score performance, to the first year of college GPAs, and finally their respective graduation rates. Based on performance on the math section of the SAT, researchers grouped students into three categories: above average, average, and below average. The categories were determined through an analysis of the mean and standard deviation from the mean. The Unskilled and Unaware Test researchers discovered the low performers over estimated their performance on the SAT relative to their peers. Average students and above average students more accurately estimated what percentile they were in. These results confirmed the existence of the unskilled and unaware phenomenon, that low performers were unable to properly understand their performance

relative to peers. When the low performers received their SAT scores and percentile placement they became aware of their relative performance.

The researchers continued to monitor the performance of all participants and found that low performers persisted through their future scholastic work. The low performers who over estimated their percentile achieved higher GPA averages than the average performers who under estimated their performance on the SAT Math section. The research team points to persistence as the reason for this outcome⁹. Persistence is a result of metacognition.

Students who take the SAT receive their test results and discover what percentile they are in. This test shows students their relative standing to their peers. Students do not necessarily understand their relative scholastic aptitude until they are compared to the national average in the SAT. The awareness of relative standing can make a large impact on one's understanding of how hard they need to work to be competitive. When being selected for a baseball team the last players remaining have instant feedback on their relative performance and they can easily rate their relative performance⁸. The low performers in the Unskilled and Unaware Test had new awareness of how skilled or unskilled they were after receiving their SAT scores. This awareness lead to metacognition, they began to think about the way they think about themselves. By understanding their scholastic abilities they started to recognize how hard they needed to work to be competitive leading to future success.

Reviewing the results of this study it is important to consider the mindset of the low performers and average performers. Mindset can make or break a student. In this study, if the low performers had fixed mindsets the results would show discouragement by the students receiving below

⁹ Mattern, K. D., Burrus, J., & Shaw, E. (2010). When Both the Skilled and Unskilled are Unaware: Consequences for Academic Performance. *Self & Identity*, 9(2), 129-141.

average SAT math scores and result in them not challenging themselves. The persistence displayed by the low performers indicate in general they were trained with a growth mindset as they persisted to find success. The researchers acknowledge there are limitations in the study as it is difficult to compare the difficulty of the coursework of each individual; however, they speculate the optimistic low performers were more willing to try more difficult tasks than the average performers who underestimated their ability.

It can also be concluded that the average students who underestimated themselves operated with a fixed mindset. By receiving the average results they had thoughts like: “I am not special” or “I will not be the best when I go to college”. These average students assumed they would not be the best therefore they stopped trying. They did not think about their cognitive process, use metacognition, nor persist. They assumed since they did not achieve high scores they would never achieve high scores in future academic endeavors. It should also be considered the average students with a fixed mindset performed more poorly on the test as a result of setting low expectations to avoid the failure of meeting high expectations.

Dweck argues, “Test scores and measures of achievement tell you where a student is, but they don’t tell you where a student could end up.” The low performers used the knowledge they gained from their overall standings in the SAT and applied metacognitive skills, persisted, and operated with a growth mindset, they did not limit their own potential.

Case Study Three: Designing for African AIDS Orphans

Mindset is a key of success in the field of global development work. If one enters a project with a fixed mindset they will experience either partial or complete failure meeting community needs. Those who enter the field with a growth mindset may have difficulties employing enough

methodologies to avoid the pitfalls of their cognitive blind spot, however using the growth mindset will equip practitioners with skills to re-evaluate and persevere.

A team of global development practitioners developed the mission to help AIDS orphans in Zambia and South Africa. The team developed a mobile phone application designed to assist in the administration of community care centers targeted to help AIDS orphans⁴. All of the development took place in the United States. The team followed prescribed best practices and used a fixed mindset. They assumed that by following best practices they had made no missteps conceptually or in the mobile application design. For example, the practitioners surveyed locals from afar to have participatory design but did not ask the correct questions, nor realize the Zambians did not comprehend their questions. Additional cognitive blind spots included a complete misunderstanding of the countries' infrastructure, computer literacy was higher than expected, and there were cultural barriers preventing adoption of the new technology.

When the development team arrived at their first stop in a rural town in Zambia they immediately realized their application was completely irrelevant; the infrastructure vastly different than expected and the AIDS orphans did not have the needs these researchers were trying to fulfill. The team was taken aback by how wrong they were. At this point the group would either proceed with the fixed mindset deploying a mobile application with no value added or they could use a growth mindset and readjust. The team used the growth mindset. They began thinking with metacognition, and asked themselves where they went wrong. They next persisted, they decided to make the best of a bad situation and use their time in the Zambia to learn about the culture and societal needs.

The team spent a lot of time immersing themselves in the local culture. They discovered that the community had a larger fear of snakes than fear of AIDS even though AIDS results in more deaths. The Zambians would burn large fields when they saw a snake to kill and drive the snakes away.

This created a lot of local pollution and was destroying the environment. The development team identified a real need of the community to track and understand the threat of snakes. As a result they built a mobile application that served the needs of the community to use social media to pinpoint snakes and estimate danger. As a result the community felt safer, they no longer required massive burning of the bush, and used fire sparingly.

The team not only persisted through the field work, but upon returning from the trip they reconvened to discuss the failures and how they were able to learn from the failures. As a result the team developed a set of criteria for the development community to use to avoid cognitive blind spots. They were able to switch gears and make future recommendations to avoid this pitfall. Understanding and realizing the dangers of the cognitive blind spot is essential to the discipline of global development work.

Each global development problem addressed by outsiders should be approached as an ill-defined problem with many unknown variables. The global development practitioners should utilize metacognitive reasoning to help overcome these cognitive blind spots. While a prescribed list of steps may look different for every professional, it is important for professionals to develop their own guide that encourages use of the growth mindset.

Conclusion

One's potential when using a growth mindset is unstoppable. Growth mindsets problem solve to learn, not to win. As seen in all three case studies those who used a growth mindset were successful, while those with a fixed mindset did not. Those who used a growth mindset used metacognition and as a result persisted to work through difficult problems. It is important to understand the cognitive blind spot in all professions. Individuals with the growth mindset

recognize cognitive blind spots exist as they actively pursue the discovery of them. The growth mindset makes for a more skilled problem solver and better professional.