

Can the Growth Mindset encourage girls to pursue “male” careers?

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SUMMARY

Despite major advances in gender equality, men still far outnumber women in science, technology, engineering and math (STEM) professions. The purpose of this project was to determine whether mindset could affect a student’s future career choices and whether this effect differed based on gender. In a growth mindset, people believe that their most basic abilities can be developed through dedication and hard work, while a fixed mindset assumes that our character, intelligence, and creative ability are static givens. We hypothesized that girls with a growth mindset would be more likely to consider pursuing careers typically chosen by males, in the future, compared to girls with a fixed mindset. Using the Dweck mindset quiz, each subject was assigned either a growth or fixed mindset. Subjects were then shown gendered, workplace pictures and asked to identify careers they would like to pursue. Males picked more potential careers, in general, compared to females (7 vs. 5, out of 10 options). When looking within the gender groups, 86% of females who had a growth mindset were likely to consider a “male” career, whereas only 16% of females with fixed mindset would likely to consider a “male” career. Especially for girls, cultivating a growth mindset may be a great strategy to address the problem of fewer girls picking STEM careers. The more we believe we can, the more we can accomplish!

INTRODUCTION

Although improvements have been made in gender equality, the recruitment of females into Science, Technology, Engineering, and Math (STEM) careers is still much lower than males. According to the U.S Bureau of Labor Statistics, in 2019, men are more than twice as likely as women to be employed in computer and mathematical occupations, more than three times as likely as women to be employed in architecture and engineering occupations, and nearly five times as likely as women to be employed in construction occupations (1). On the other hand, women are nearly twice as likely as men to be employed in social service occupations and nearly three times as likely as men to work in personal care, service, educational, or library occupations (1). Researchers

at Carnegie Mellon University used functional brain magnetic resonance imaging (MRIs) and the Test of Early Mathematical Ability for 3- to 8-year-old children to show that the brains of boys and girls are similar at this age and both genders have equal math ability (2). O’Dea and colleagues combined data from hundreds of studies and showed that that academic STEM achievements of boys and girls were very similar — in fact, the analysis suggested that the top 10% of students, in both STEM and non-STEM subjects, across various grade levels contained equal numbers of girls and boys (3). So, when it comes to picking a STEM profession if girls can do it, then why are they not doing it? Researchers believe there may be many explanations for this trend, but one major reason is that girls lack the confidence in their ability to succeed in math and science tracks (4). They tend to believe stereotypes about which careers are meant for boys and not as suitable for girls (5); perhaps we therefore must first know and believe that we can do it.

If society is constantly reinforcing gender stereotypes in both subtle and obvious ways, it will take a long time to make a change on a broad societal level. However, if we could empower young girls and give them mental tools to perceive their own abilities, they might strive to accomplish goals that they previously thought to be “too hard” or more suited to boys. Also, fostering a growth mindset could help *all* students. Carol Dweck studied the behavior of thousands of children and established the terms “fixed mindset” and “growth mindset” to describe the underlying beliefs people have about learning and intelligence (6). According to Dweck, people can adopt one of two mindsets about their abilities: a fixed or growth mindset. Those with a fixed mindset believe their basic intelligence cannot be improved (6). They interpret a challenge, like a bad grade in math, as a sign that they simply do not have the ability; they may then opt for a safer path. They also believe that talent alone leads to success, and effort is not required. By contrast, people with a “growth mindset” think their abilities can be improved with effort, strategy, and mentoring. Despite being challenged, they will persist even with setbacks and failures. When people believe they can become smarter, they realize that their effort has an effect on their success, so they put in extra time that leads to higher achievement.

Dweck’s research offers the intriguing possibility that this

mindset phenomenon may be relevant to girls and how they decide upon a career based on their perception of their own abilities and talents. Are boys and girls different in terms of growth and fixed mind sets? And does the type of mindset a person has influence which careers they see themselves doing in the future? In this study, we hypothesized that girls who have a growth mindset will choose traditionally “male” careers more often than girls who have a fixed mindset. We found that a growth mindset among girls is associated with their ability to consider a career outside their gender norm as a future possibility while a fixed mind set was more prevalent among girls who picked careers traditionally associated with women.

RESULTS

A total of 71 subjects were recruited including 40 females and 31 males. The group consisted of 39 subjects in elementary school and 31 subjects in middle school. Each subject completed the mindset quiz and received a score was assigned between 0 and 30. Based on the score chart, the subject was assigned a fixed mindset for scores ≤ 18 , and a growth mindset for scores ≥ 19 (6). Most subjects in our study had growth mindset scores that fell within the category of “strong growth mind set” (Figure 1). Among the 40 female subjects, 28 (70%) had scores which place them in the growth mindset category while 22 out of the 31 (71%) male scores fell into the growth mindset category. There was no significant difference between the males and female mindsets (p -value = 0.9293) (Figures 2A-2B). The middle school group had slightly more fixed mindset subjects than elementary school (25% versus 22%) but this was not statistically significant either (p -value = 0.1027) (Figure 2C-2D).

Males picked more possible future careers that they could envision themselves doing, compared to females (seven vs. five, out of 10 options). When looking within the gender groups, 86% of females who had a growth mindset were more likely to consider a “male” career, whereas only 16% of females with a fixed mindset were likely to consider a “male” career. The results were quite different for the males: 67% of males with a growth mindset picked “male” careers, while 90% of males with a fixed mindset picked “male” careers (Figure 3).

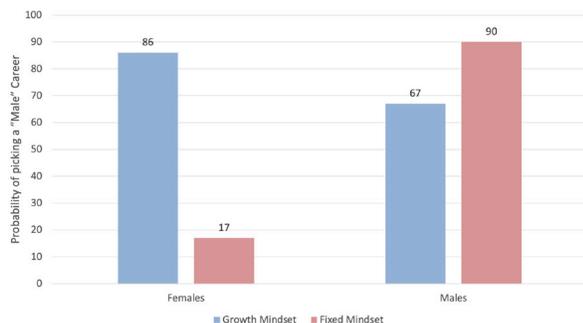


Figure 2. Effect of mindset on picking a “Male” career. The results from the experiment came to show that that 67% of males with growth mindset picked STEM careers versus the 90% of males with fixed mindset picking STEM careers.

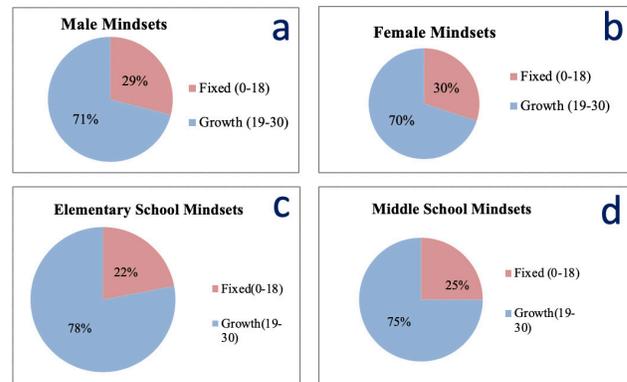


Figure 1. Distribution of mindset. The four graphs here demonstrate the categories in which growth mind set scores fell. A and B show male and female subjects appeared almost identical in terms how many had fixed versus growth mindsets. C and D show the distribution of mindset type based on age – elementary schoolers were 3% more inclined towards the growth distribution as opposed to middle schoolers.

DISCUSSION

The purpose of this experiment was to determine whether mindset could influence future career choices and, if so, was this effect different based on gender and age. Our hypotheses were partially correct; overall, similar proportions of boys and girls had a growth mindset. However, among females, that growth mindset was associated with an apparent increase in the number of subjects who would consider a future career that would be considered more typical for males. At least some of these options included STEM careers as well. Interestingly, within males the reverse was true and more males with a fixed mindset picked traditional male careers. This might be because males who are fixed in their mindset will easily pick stereotyped male. Given that many STEM careers are traditional male dominated fields, this might suggest that females who are of a fixed mindset chose to also steer

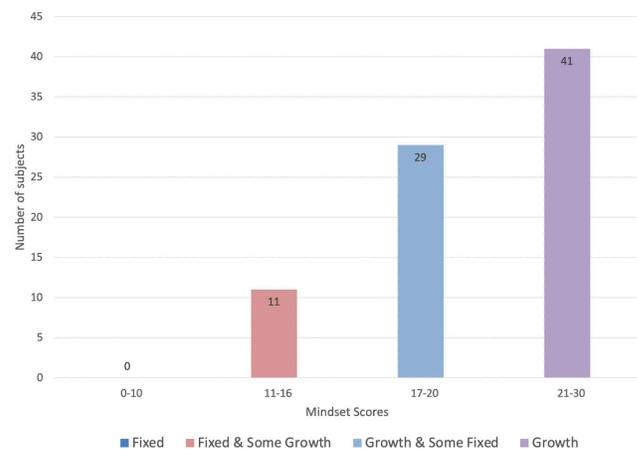


Figure 3. Distribution of mindset groups. The compilation and organization of quiz scores from Figure 1. Results from it come to show the distribution of the results. 41 of the 71 people surveyed possessed the growth mindset, 0 possessed the fixed, and 30 fell somewhere between those lines.

away from such STEM careers. It was notable that females picked less career options, overall, when compared to males. Perhaps this is because females feel more constrained in their career choices and have trouble seeing themselves in both male and female types of jobs.

It is remarkable that mindset may determine how one thinks about future career options. Researchers have shown that a growth mindset about intelligence can be taught to students and can halt the common decline in math performance of middle school students (7). Prior research by Cheng and colleagues showed that a growth mindset can help students achieve higher grades in math coursework and they are also more likely to pursue a STEM degree in college and pursue a STEM career. Interestingly they even describe that a growth mindset in the parents can also be associated with such outcomes among the children (8)

While prior research has shown that growth mindsets are more prevalent in STEM fields than in the arts, this study shows that females who lack a growth mindset shy away from “male” careers. Thus, for girls, this may represent an opportunity to address the huge problem of not picking STEM careers; the idea of cultivating a growth mindset and using it as a tool to diminish the gender gap for STEM careers is very intriguing. Research has shown that as the child’s brain is developing is constantly remodeling its internal connections and it is also very responsive to external stimuli – a phenomena described as brain plasticity. Also, there are periods of brain development where certain types of input are essential for certain forms of development and such “critical periods” can be a vital time for certain exposures (10). In addition, studies have used certain neurologic tests such as electroencephalography (EEG; looking at brain wave forms) and MRI (looking at anatomy of brain regions) to show certain parts of the brain are specifically involved in generating growth mindset (9). So, if we try to create a growth mindset during critical periods of development, we may be able to use the neuroscience of mindset to encourage more girls to consider traditional male dominated STEM careers.

These findings have highlighted the possibility of a very important psychological intervention which may be used to encourage more girls to pursue careers typically considered “male”, including STEM careers. This study was limited by the fact that only an association between mindset and career choices reported; causation could not be established because no actual intervention was used on the subjects. Additionally, envisioning oneself in a future career is not the same as picking that as a career choice in the future. Only a longitudinal study, which follows subjects over time, can prove that. In the future we would like to design a growth mindset video which can teach kids about the growth mindset and examine its effect on students picking STEM career options.

We must make an effort to teach female students of all ages about the growth mindset and explain how brain plasticity works. If we can influence the way that career choices are perceived, starting at a young age, we may be

able to expand the number of girls who choose traditional male dominated careers including many in the STEM fields. The more we **believe we can**, the more **we can** accomplish!

METHODS

A total of 71 subjects were recruited from local elementary and middle schools. A brief informational handout explaining the experiment was provided to the subjects and their guardians and informed consent was obtained from the parent, while assent was obtained from the minors.

Each subject completed the mindset quiz (accessed at <https://advising.unc.edu/wp-content/uploads/sites/341/2020/07/MINDSET-Quiz.pdf>) and a score was assigned between 0 and 30. Based on the score chart, the subject was assigned a fixed mindset for scores ≤ 18 , and a growth mindset for scores ≥ 19 (6). Each student was presented with 8.5×11-inch color photographs of 11 workplaces representing 11 different occupations or careers. Photographs were obtained from a Google image Internet search of downloadable images. Based on Bureau of Labor Statistics (BLS) data specifying the ratio of men to women employed in different occupations (1), the images depicted one “neutral” career, five “female” careers, and five “male” careers. The workplace pictures had no male or female workers in it. The male-dominated occupations included construction worker, firefighter, pilot, doctor, and police officer (Figure 4A). The female-dominated occupations, as per BLS, were teacher, librarian, day care worker, flight attendant, and nurse (Figure 4B). The “male careers” included those that would be considered STEM

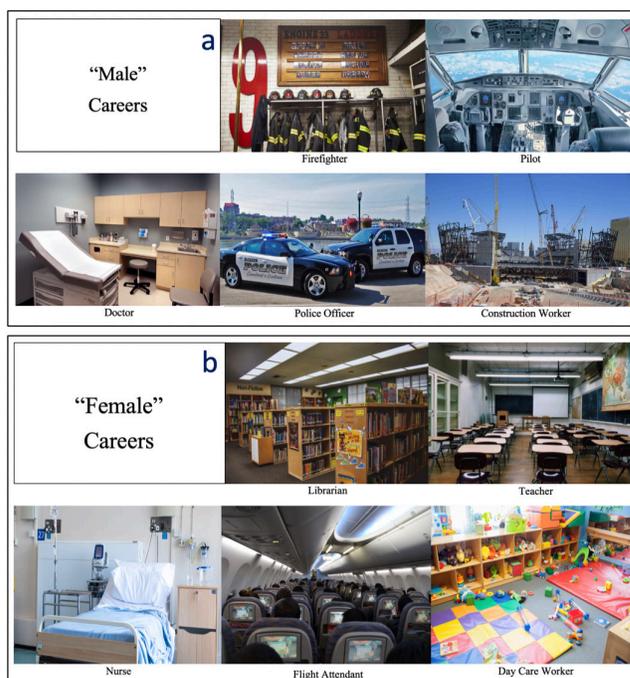


Figure 4. Images of “Male” versus “Female” careers. The two sets of images are the ones shown to the participants, which portray careers deemed to be those for males (group A) and those deemed to be those for females (group B).

careers as well. In addition to being based on data from the Bureau of Labor Statistics, the pictures were also selected based on how easily they would be recognized by elementary students and would have a stereotypical association with "male" or "female" gender.

Each picture was accompanied by a verbal a one-sentence description of the photo; for example, the picture of the fire station was presented with the statement: "This is a fire station, where a firefighter works." The neutral (restaurant) picture was presented first, as practice. Subjects were asked the questions, "Would you consider doing a job like this in the future?" and "Is this something that you think you would be able to do?" If a subject picked three to five male careers, he/she was considered "likely" to pursue a male career. Results were tabulated and graphed. To "pick" a certain career the subject would have to answer "yes" to both questions. Given the small number of subjects this was manually recorded and calculated.

Group differences were analyzed using the chi square method.

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