

Daniel Anton

When to teach intellectual humility? An investigation into high school and middle school students

S-BEHA-016

Abstract

Students who exhibit more helpless behaviors will almost always perform worse in school. Schools may be inadvertently teaching these students more helpless behaviors through current methods. So how can we give students more mastery behaviors? One method may be using intellectual humility. The purpose of this study was to confirm the existing relationship between growth mindset, intellectual humility, and mastery behaviors, find alternative methods to increasing intellectual humility in students, and see how different age groups respond to influences on intellectual humility and mastery behaviors. In this study, videos were used to teach mindsets to students and intellectual humility, mastery behaviors, and helpless behaviors were measured. A correlation was found between intellectual humility and mastery behaviors ($p = .0001$, $r = 0.394$), supporting previous research. The treatment also significantly increased middle school students' intellectual humility across multiple groups. This not only provides a new method to get students to learn more helpful behaviors but also suggests that researchers should focus their efforts on teaching intellectual humility at a younger age.

Acknowledgements

I would like to thank my mentor, teacher, school district, district teachers, and fellow science research students for their support, feedback, and guidance throughout this process.

Table of Contents

I.	Abstract	1
II.	Introduction	2
III.	Purpose	4
IV.	Materials and Methods	4
	i. Participant Recruitment	4
	ii. Group Placement	5
	iii. Mindset Manipulation	5
	iv. Scale Collection	6
V.	Results	7
VI.	Discussion and Conclusion	12

List of Tables and Figures

Table 1.	Two-tailed pearson correlation between Intellectual Humility, Mastery Behaviors, and Helpless Behaviors.	7
Figure 1.	Scatterplot of correlation between Intellectual Humility and Mastery Behaviors.	8
Figure 2.	Bar graph of means of Intellectual Humility, Mastery Behaviors, Helpless Behaviors for High School Control Group, High School Fixed Group, and High School Growth Group.	9
Figure 3.	Bar graph of means of Intellectual Humility, Mastery Behaviors, Helpless Behaviors for Middle School Control Group, Middle School Fixed Group, and Middle School Growth Group.	10

Introduction

If you give two students the same test and they receive a similar failing score, you might be surprised by just how different two students can be. On one side, Student A may give up, believe that the test was rigged against them in some way, and in extreme cases never study for the class again. Student B however will thrive in this failure. They'll challenge their previously conceived misconceptions by studying harder or seeking help from their teacher. Needless to say, Student B will almost always perform better on the next test than Student A. But what is the difference between these two students? What causes these two students to develop differently? And if possible, can we transform Student A into Student B?

Those like Student B, or those who embrace challenges, are understood to have **mastery behaviors**. Mastery behaviors can be defined as, "the seeking of challenging tasks and the maintenance of effective striving under failure" (Dweck and Leggett, 1998). In a comprehensive meta-analysis, mastery behaviors were found to encompass effective problem-solving, self-control, higher grades, and internal satisfaction (Burnette et al., 2013). However, students in the A category mentioned above can be considered to have the opposite, helpless behaviors, described as "an avoidance of challenge and a deterioration of performance in the face of obstacles" (Dweck and Leggett, 1998).

Interestingly, students who avoid challenges are initially equal in ability to those who seek them (Dweck and Leggett, 1998). So what causes students to deviate so drastically? A variety of socioeconomic factors could be the reason. The school system in particular plays a very important role in the development of these behaviors. It is a system most children interact with on a daily basis. Education in the United States of America consistently rewards perceived intelligence by promoting fixed mindsets in schools (Dweck, 2014). The idea of "performance goals" such as getting a certain grade on a test that most schools follow can generate more helpless behaviors (Dweck and Leggett, 1998). These performance goals exist in schools through examples such as standardized tests, which claim to assess students on an equal playing field, ignoring school funding or outside responsibilities. Then, students who consistently fail begin to develop the idea that they cannot improve themselves. They view their difficulties as something that is solely caused by their perceived ability on these tests. Therefore, some students, mostly those with less desirable socioeconomic backgrounds, will understandably run in the face of challenge. We may be inadvertently increasing helpless behaviors in students.

To begin to address this issue, we need to ask what makes up these behaviors. **Growth and fixed mindsets** seem to play an important role in mastery behaviors (Blackwell et al., 2007; Burnette et al., 2013; Dweck and Leggett 1998). Growth mindset is the belief that your mind is malleable and can be developed, while a fixed mindset is the belief that there is little you can do to change your intelligence. These connect to mastery behaviors and helpless behaviors respectively. However, what may actually motivate Student B to seek the answers to their failures? This is another component of mastery behaviors known as **intellectual humility**, a relatively new field of research within social psychology.

While many studies attempt to define what falls into intellectual humility, it can be best described as recognizing that a particular belief may be fallible, along with valuing others intellect (Leary et al., 2017; Porter and Schuuman 2017). Along with defining intellectual humility, early studies have found it a significant predictor of openness to opposing views (Porter and Schuuman, 2017), and scrutiny of misinformation (Koetke et al., 2021; Koetke, Schuuman, and Porter, 2021). Additionally, Porter et al. (2020) also found that intellectual humility significantly predicted mastery behaviors.

So how can we attempt to increase mastery behaviors in students? While this study alone cannot seek to combat these socioeconomic factors or change the school system, it can use the fact that a school-like environment is imperative to the development of intellectual humility. A teacher's style, one that promotes growth and learning, is influential in developing mastery behaviors, intellectual humility, and other positive skills (Dweck and Leggett, 1998; Shoshani and Steinmetz, 2013; Porter et al., 2022). While early studies have emerged that suggest increasing intellectual humility through fallibility salience manipulation (forcefully making participants aware of their limitations) and growth mindset articles (Koetke et al., 2021, Porter and Schuuman, 2017), more methods are needed for students. In addition, no studies were found that researched different age groups' reactions to being taught intellectual humility. In this study, growth mindset videos were used in an attempt to increase intellectual humility and therefore mastery behaviors in both high school and middle school groups.

Purpose

The purpose of this study was to confirm the existing relationship between growth mindset, intellectual humility and mastery behaviors, find alternative methods to increasing intellectual humility in students, and see how different age groups respond to influences on intellectual humility and mastery behaviors. This study could have broader societal impacts, both to validate intellectual humility as a key component of growth mindset, and offering new ways to increase intellectual humility and mastery behaviors with the help of a school environment. It can also help us to understand at what age attempting to increase intellectual humility would be most beneficial to the student.

Materials and Methods

Participant Recruitment

Participants in both the high school and middle school groups were part of the same district in the Lower Hudson Valley. Participants were recruited in the high school in early June of 2022 and September of 2022 by advertising through posters and classes. A \$20 gift card raffle was also offered. The study was conducted twice at the high school, both during the same month as the recruitment. For the middle school group, the study was advertised to three classes in September of 2022 and was conducted in the same month. In all cases, students had the choice of whether or not to participate in the study. All students required a signed parental consent and minor assent form approved by the school's IRB and received basic knowledge of the study.

In total, 109 participants took part in the study, 49 high school students and 60 middle school students. High school students were excluded for writing their name, therefore voiding anonymity ($n = 6$) and incorrectly filling out the questionnaire ($n = 2$). Middle school students were excluded for writing their name ($n = 1$), incorrectly filling out the questionnaire ($n = 1$), and failing an attention check ($n = 11$). This left the study with 41 high school students (56% Female, 42% Male, 2% Non-Binary, $M(\text{age}) = 16.34$, $SD = 0.938$, 68% White, 15% Asian, 2.5% Hispanic, 2.5% Black; 12% Two or More Races) and 47 middle school students (55% Female, 43% Male, 2% Non-Binary, $M(\text{age}) = 11.81$, $SD = 0.532$, 43% White, 17% Hispanic, 11% Black, 6% Asian; 19% Two or More Races; 4% Other), for a total of 88 participants whose data was used. The demographic information was similar to the 2020 New York Census (61.6% White, 18.7% Hispanic, 12.4% Black, 6% Asian, 1.1% Native American, 0.2% Native Hawaiian and Other Pacific Islander; 10.2% Two or More Races; 8.4% Other). It is important to note the census data adds up to 118.6% compared to 100%.

Group Placement

Participants were randomly sorted into three groups for each school: a control group, a growth mindset group, and a fixed mindset group. The participants were not made aware of their grouping until the end of the study. This was to reduce bias and to assume that all groups were equal in various backgrounds. The control group would serve as a standard assessment of students in the school.

Mindset Manipulation

Three similar 3-minute length videos were created for this study. Each video's main message corresponded to a group (For example, the fixed mindset group students watched a video about fixed mindset). Participants in previous studies saw a temporary increase in intellectual humility when given growth mindset articles while participants given fixed mindset articles saw a temporary decrease in intellectual humility (Porter and Schuuman, 2017). The growth and fixed mindset videos reused material from articles in the previous study by Porter and Schuuman.

All three videos used a teacher from the district as its speaker. To control for any unintentional variables, the growth mindset video and fixed mindset video followed the same structure and studies. However, what differed was the results and conclusions stated in the video. The fixed video would report data coinciding with fixed mindset, while the growth video would report data coinciding with growth mindset. The control video mentioned nothing related to mindset to keep the group as a general assessment of the normal student population. Videos are available upon request.

All six groups met in a classroom like-setting, with a teacher to serve as a neutral third-party while the study was being conducted. At the beginning, students were given an introduction to obscure the true nature of the study from participants and ensure they answered honestly.

Each group then watched the video related to their group. Participants were asked to write three to four lines about the video's main idea. This was to serve as an attention check, and allow the participants to internalize the message of the video. It also continued the false nature of the study. Participants then answered questions anonymously. Participants were asked to rate difficulty, agreement, and importance of the video on a self-report Likert scale. This scale's data was not used. This was done to get students used to rating their feelings on a Likert scale and to provide a red herring to the true nature of the study.

Scale Collection

Participants were then further instructed to answer questions about personality, attitude, and beliefs right now. The incorporation of the phrase “right now” was to understand the effectiveness of the video in the moment. In similar studies that used a short piece of media, participants' intellectual humility was expected to return to normal fairly quickly after the study (Porter and Schuuman, 2017). However, if effective, this method could still work as a springboard to larger, more permanent changes if given proper attention.

Participants then answered the Modified 6-Item Intellectual Humility Self-Report Scale (Porter & Schumann, 2018; Porter et al., 2020). This modified 7-point Likert scale contained 6 questions that sought to analyze students' intellectual humility directly after watching their video. This has been used in similar scientific studies. This scale was modified to include simpler yet similar questions for younger students. The original scale had 9 questions but the modified version removed 3 of the reverse-coded items on the scale to clear any misunderstandings. This was cleared with the original creator of the scale before being put into practice. Examples of questions asked were “I try to think about my weaknesses in order to develop my intelligence” and “I actively seek feedback on my ideas, even if it is negative”.

To measure mastery behaviors, participants were asked to imagine failing a quiz. Participants then responded to the 5-item Mastery Behaviors Self-Report Scale (Blackwell, Trzesniewski, & Dweck., 2007), a 5-point Likert scale designed to measure a student's mastery and helpless behaviors using the above prompt. This has been used in similar scientific studies. Some next steps included, “I would try to understand what I did wrong”, “I would work harder in the class from now on”, and “I would spend less time on the subject”.

Participants then completed a demographic survey and were finally debriefed on the true nature of the study. Participants were allowed to ask any questions or withdraw their data. Finally, participants were asked to not speak about the study if they knew other participants to avoid bias. A sample of the student questionnaire including the modified scales is available upon request.

Results

An alpha of 0.05 was set as the significance value for this study. First, a two-tailed Pearson Correlation was run to compare intellectual humility to both mastery behaviors and helpless behaviors. Intellectual humility positively correlated with mastery behaviors ($p = 0.0001$, $r = 0.394$). This value was statistically significant. Mastery behaviors were also found to negatively correlate with helpless behaviors ($p = 0.028$, $r = -0.235$). This value was statistically significant as well. However, intellectual humility and helpless behaviors did not have a statistically significant correlation ($p = 0.159$; Table 1, $r = -0.151$; Figure 1).

		IH	MB	HB
IH	Pearson Correlation	1.000	.394	-.151
	Sig. (2-tailed)		.000*	.159
	N	88	88	88
MB	Pearson Correlation	.394	1.000	-.235
	Sig. (2-tailed)	.000*		.028*
	N	88	88	88
HB	Pearson Correlation	-.151	-.235	1.000
	Sig. (2-tailed)	.159	.028*	
	N	88	88	88

Table 1. Two-tailed pearson correlation between intellectual humility, mastery behaviors, and helpless behaviors. * represents significance at .05 level.

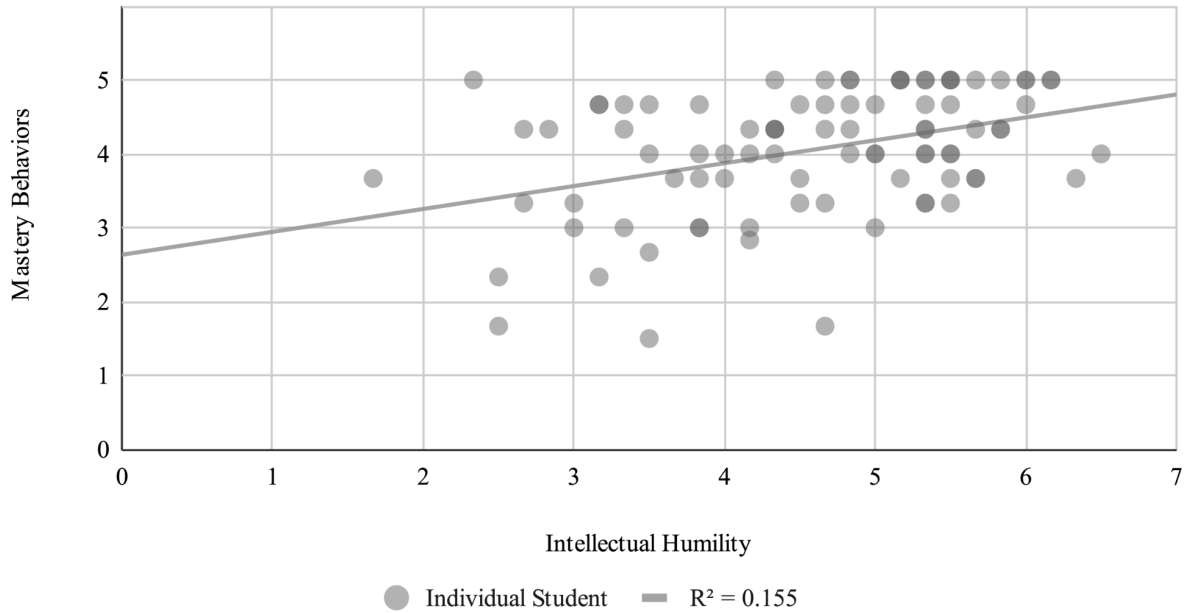


Figure 1. Scatterplot of correlation between intellectual humility and mastery behaviors.

Note: Darkened dots represent multiple students who reported the same values for both intellectual humility and mastery behaviors.

A one-way ANOVA test was then used to compare all three high school groups intellectual humility, mastery behaviors, and helpless behaviors after the experiment was conducted. The one-way ANOVA (Figure 2) did not find significance between the high school groups for intellectual humility ($F(40)$, $p = .095$), mastery behaviors ($F(40)$, $p = .065$), and helpless behaviors ($F(40)$, $p = .726$).

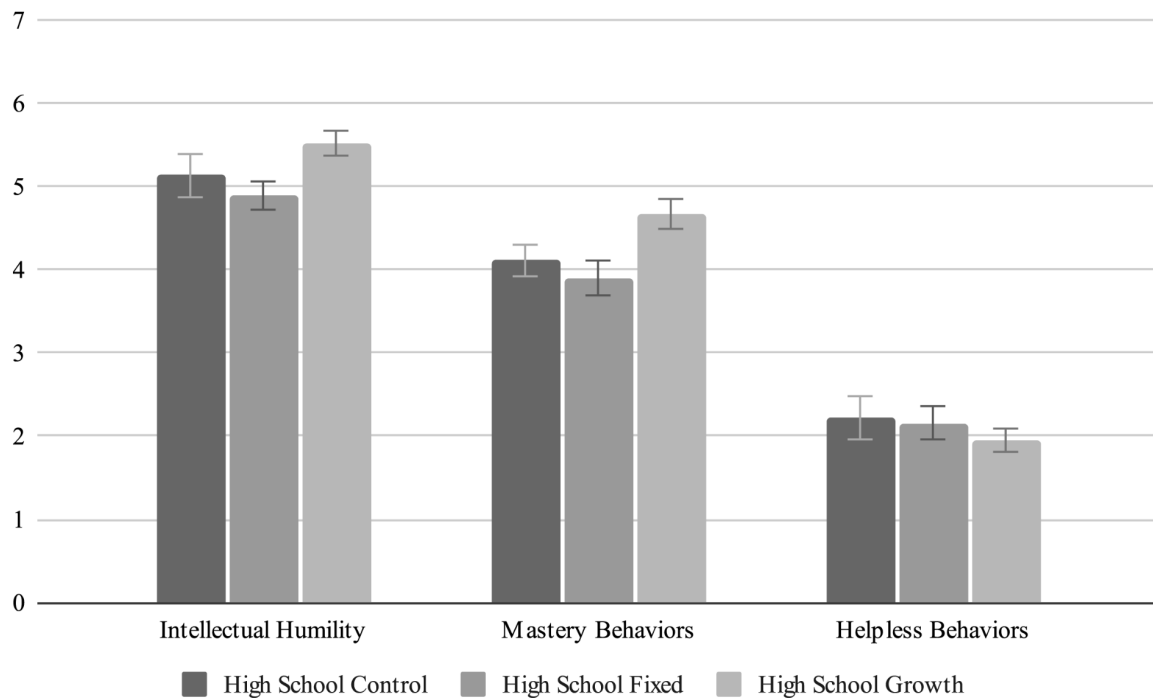


Figure 2. Bar graph of means of Intellectual Humility, Mastery Behaviors, Helpless Behaviors for High School Control Group, High School Fixed Group, and High School Growth Group.

Note: Error bars represent 95% confidence intervals.

A one-way ANOVA test was then used to compare all three middle school groups' intellectual humility, mastery behaviors, and helpless behaviors after the experiment was conducted. The one-way ANOVA (Figure 3) found significance between the groups for intellectual humility ($F(46)$, $p = .001$). However, it did not find significance for mastery behaviors ($F(46)$, $p = .501$) or helpless behaviors ($F(46)$, $p = .451$).

After a test for homogeneity of variances for intellectual humility ($p = .230$), it was determined that a Tukey HSD post hoc follow up would be used. The mean of intellectual humility was significantly different between the growth mindset group ($M = 4.86$, $SD = 1.06$, $[4.30, 5.43]$) and control group ($M = 3.93$, $SD = 1.00$, $[3.40, 4.46]$; $p = .024$, 95% CI = $[-.10, 1.77]$) as well as the growth mindset group and fixed mindset group ($M = 3.54$, $SD = .84$, $[3.08, 4.01]$; $p = .001$, 95% CI = $[-.47, 2.17]$). However, intellectual humility was not significantly different between the fixed mindset group and control group ($p = .522$).

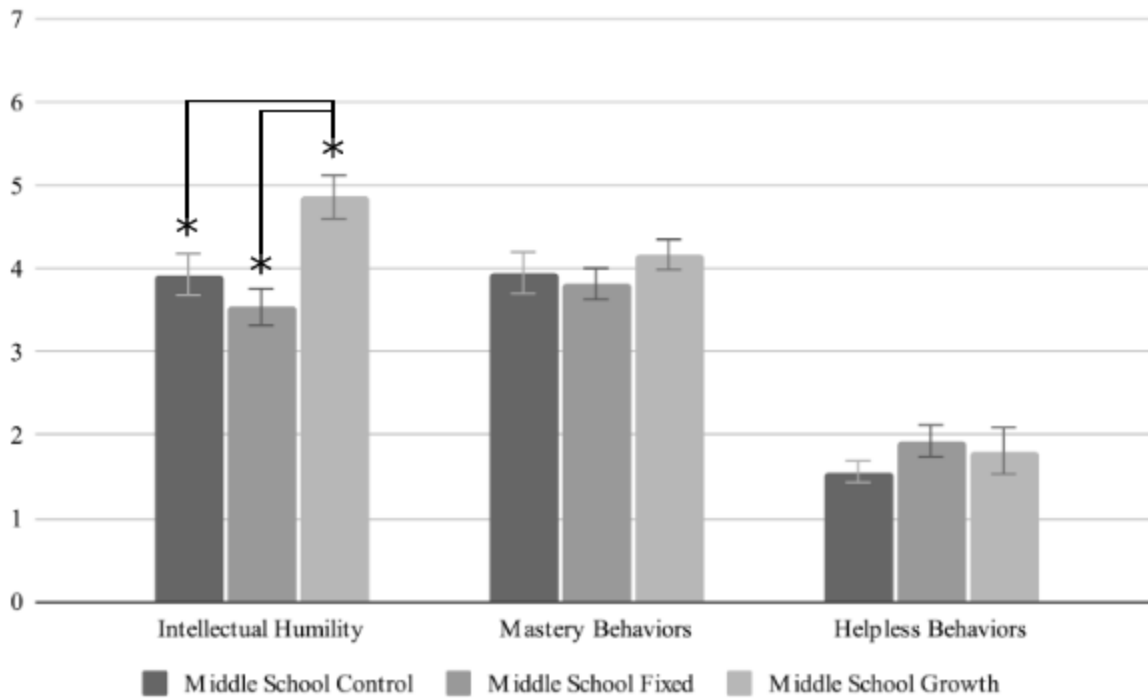


Figure 3. Bar graph of means of Intellectual Humility, Mastery Behaviors, Helpless Behaviors for Middle School Control Group, Middle School Fixed Group, and Middle School Growth Group.

Note: Error bars represent 95% confidence intervals. * represents significance at .05 level.

After comparing the two groups separately, a two-tailed independent t-test was used to compare each high school and middle school group with the same treatment and their respective intellectual humility, mastery behaviors, and helpless behaviors.

For the control group, there was a significant difference in intellectual humility between the high school group ($M = 5.13$, $SD = .78$) and middle school group ($M = 3.93$, $SD = 1.00$; $t(23) = 3.12$, $p = .005$). There was also a significant difference in helpless behaviors between the high school group ($M = 2.22$, $SD = .58$) and middle school group ($M = 1.56$, $SD = .51$; $t(23) = 2.53$, $p = .019$). However, there was no significant difference in mastery behaviors between the high school group ($M = 4.11$, $SD = .58$) and middle school group ($M = 3.95$, $SD = .98$; $t(23) = .45$, $p = .655$).

For the fixed mindset group, there was a significant difference in the intellectual humility between the high school group ($M = 4.89$, $SD = .80$) and middle school group ($M = 3.54$, $SD = .84$; $t(35) = 4.92$, $p = .0001$). However, there was no significant difference in mastery behaviors between the high school group ($M = 3.90$, $SD = 1.00$) and middle school group ($M = 3.82$, $SD = .72$); $t(35) = .26$, $p = .794$) or helpless behaviors between the high school group ($M = 2.16$, $SD = .92$) and middle school group ($M = 1.93$, $SD = .51$; $t(35) = .80$, $p = .432$).

Finally, for the growth mindset group, there was a significant difference in intellectual humility between the high school group ($M = 5.52$, $SD = .46$) and middle school group ($M = 4.86$, $SD = 1.06$; $t(22.10) = 2.16$, $p = .042$). However, there was no significant difference in mastery behaviors between the high school group ($M = 4.67$, $SD = .57$) and middle school group ($M = 4.17$, $SD = .72$; $t(24) = .075$) or helpless behaviors between the high school group ($M = 1.95$, $SD = .44$) and middle school group ($M = 1.81$, $SD = 1.12$; $t(21.10) = .44$, $p = .665$).

Discussion and Conclusion

The study sought to do three things. The first was to support previous studies that found intellectual humility to positively correlate with mastery behaviors. The second was to test a novel method of influencing intellectual humility, mastery behaviors, and helpless behaviors through mindset videos. The third was to determine if it would be more effective to teach these behaviors to students earlier in their education.

Intellectual humility was found to once again be significantly and positively correlated with mastery behaviors, confirming existing studies about the link between these two variables. A correlation coefficient of $r = 0.394$ is high for studies that linked intellectual humility and mastery behaviors ($r = 0.13$; Porter et al., 2020)

As mentioned previously, the one-way ANOVA found no significance between any of the high school groups. However, the middle school group found a significant difference between the growth mindset group and control group, and growth mindset group and fixed mindset group for intellectual humility. The novel growth mindset videos were effective in increasing intellectual humility in middle school students. A possible explanation for this could be that high schoolers' views are more set in stone, and therefore it is more difficult to influence intellectual humility. However, the minds of middle schoolers may be more malleable and therefore saw a greater difference when presented the video. In the future, researchers may want to focus on teaching intellectual humility early on in middle school students.

Two interesting results from this study revealed themselves in the middle school group. The first was that the fixed mindset group and control group did not have a significant difference in intellectual humility. A fixed mindset may be the average state for younger students, which is concerning and should be studied further. The other interesting result was that a significant difference in intellectual humility did not mean a significant difference in mastery behaviors. While intellectual humility is still an extremely useful skill, labeling these videos as a success, another variable besides growth mindset may want to be used to teach both at the same time. Perhaps an increase in mastery behaviors would be seen in more longitudinal studies.

When comparing the high school and middle school groups, the control group in the high school had significantly higher intellectual humility than the middle school group. After researching the school district further by talking to teachers and reading the district website, this school in the Lower Hudson Valley promotes “equity, innovation, and optimism”. While students continue throughout the district, they may ultimately graduate with higher levels of intellectual humility than their middle school counterparts. However, these videos are still needed. Other schools are less diverse and have not committed to teaching their students these helpful behaviors, and by seeing the significant difference in these middle school groups, using these videos as a basis has the potential to propel students further than the current method to growth mindset this school employs.

There were several limitations to this study. As opposed to measuring students' increases in intellectual humility and mastery behaviors over time, comparing a control group to experimental groups directly after watching their video only shows temporary increases. More longitudinal studies are needed to see if a combination of addressing intellectual humility and more interventions can lead to more long-lasting effects. Due to the intended audience these scales were created for (6th-grade students and above), the district's elementary school was not tested. However, if future studies alter these videos and questionnaires for comprehension, it may be a useful follow-up to see if differences in intellectual humility hold for the elementary school. The last limitation was the number of middle school students who failed the attention check. The amount of middle school students who were unable to summarize the main idea of the video is a worthy topic of discussion. Because the same videos were made for both the high school and middle school, and developed by a high school student, the videos may have not used simple enough language or ideas to connect with the middle school students. Future research may want to modify the videos used and speak with middle school students about problems with understanding the video before conducting the experiment.

Overall, this study confirmed existing correlations between intellectual humility and mastery behaviors. It also offered a novel way to temporarily increase intellectual humility and presented the idea that efforts to increase intellectual humility, such as future longitudinal studies, should be focused more on middle school students compared to high school students. By increasing intellectual humility, students can go on to develop more helpful behaviors and become more positive students and citizens, combating some negative effects related to our current system of education.

Bibliography

- Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child Development, 78*(1), 246-263. <https://doi.org/10.1111/j.1467-8624.2007.00995.x>
- Burnette, J. L., O'boyle, E. H., Vaneppps, E. M., Pollack, J. M., & Finkel, E. J. (2013). Mind-sets matter: A meta-analytic review of implicit theories and self-regulation. *Psychological Bulletin, 139*(3), 655-701. <https://doi.org/10.1037/a0029531>
- Carol Dweck: *The power of believing that you can improve* [Video]. (2014, November). TED. https://www.ted.com/talks/carol_dweck_the_power_of_believing_that_you_can_improve
- Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review, 95*(2), 256-273. <https://doi.org/10.1037/0033-295X.95.2.256>
- Koetke, J., Schumann, K., Porter, T., & Smilo-Morgan, I. (2021). Fallibility salience increases intellectual humility: Implications for people's willingness to investigate political misinformation. <https://doi.org/10.31234/osf.io/kft54>
- Koetke, J., Schumann, K., & Porter, T. (2021). Intellectual humility predicts scrutiny of covid-19 misinformation. *Social Psychological and Personality Science, 13*(1), 277-284. <https://doi.org/10.1177%2F1948550620988242>
- Leary, M. R., Diebels, K. J., Davisson, E. K., Jongman-sereno, K. P., Isherwood, J. C., Raimi, K. T., Deffler, S. A., & Hoyle, R. H. (2017). Cognitive and interpersonal features of intellectual humility. *Personality and Social Psychology Bulletin, 43*(6), 793-813. <https://doi.org/10.1177%2F0146167217697695>
- Porter, T., Catalán molina, D., Lucas, M., Oberle, C., & Trzesniewski, K. (2022). Classroom environment predicts changes in expressed intellectual humility. *Contemporary Educational Psychology, 70*. <https://doi.org/10.1016/j.cedpsych.2022.102081>
- Porter, T., & Schumann, K. (2017). Intellectual humility and openness to the opposing view. *Self and Identity, 17*(2), 139-162. <https://doi.org/10.1080/15298868.2017.1361861>
- Porter, T., Schumann, K., Selmeczy, D., & Trzesniewski, K. (2020). Intellectual humility predicts mastery behaviors when learning. *Learning and Individual Differences, 80*. <https://doi.org/10.1016/j.lindif.2020.101888>

Shoshani, A., & Steinmetz, S. (2013). Positive psychology at school: A school-based intervention to promote adolescents' mental health and well-being. *Journal of Happiness Studies*, 15(6), 1289-1311. <https://doi.org/10.1007/s10902-013-9476-1>

U.S. Census Bureau (2020). *New York State Population Topped 20 Million in 2020*. Retrieved from <https://www.census.gov/library/stories/state-by-state/new-york-population-change-between-census-decade.html>