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Article

Upward social comparison on standardized test performance in adolescents and adults

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SUMMARY

The use of standardized testing and its effects on students has undergone increasing debate in recent years. We utilized experimentally induced upward social comparison to better performing peers, which refers to comparing oneself to someone perceived as superior, versus comparison to peers who performed similarly. We hypothesized that this type of comparison affects adolescents' actual and perceived standardized test performance in a subsequent standardized test and their self-efficacy, their belief in their capacity to succeed, more severely as compared to adults. A sample of adolescents and adults completed ten questions from the Scholastic Aptitude Test (SAT). Then, every participant regardless of their actual score received false feedback, indicating that they scored in either the 10th percentile or the 50th percentile. Following the feedback, their performance on a second set of ten SAT questions, perceived performance on the second test, and self-efficacy was assessed. Our results partially support the presumed effects. A lower performance in the second test and less confidence about one's performance was associated with comparing negatively in adolescents. This was not the case for self-efficacy. Fisher's Z-test suggests that the correlation between negative comparisons and test performance, as well as between negative comparisons and perceived competency, was more negative in adolescents than in adults, suggesting that adolescents respond worse to negative comparisons. No such difference was found for self-efficacy. These results demonstrate the potential for unfavorable social comparisons by adolescents regarding standardized testing, and future studies are needed to investigate broader implications like how standardized testing impacts student mental health.

INTRODUCTION

For most of its time, standardized testing has been mandatory to include in applications to US colleges and has been administered in high schools around the country. Due to recent changes involving COVID-19 and the lack of reliable standardized testing measures during quarantine, the very idea of testing as a metric for student success has been debated (1-3). Research on this topic has mainly focused on discussions of the validity, reliability, and fairness of standardized testing (4,5). Yet, beyond mere quality of assessment, standardized testing may have consequences for test takers. Standardized tests often correlate with high levels of stress and anxiety about one's own performance (6). Those who score lower than their peers or lower than the national average would likely experience more fear surrounding their future educational and professional opportunities, which can ultimately reduce confidence and foster other negative consequences (6).

One of the metrics commonly used to assess the relevance of standardized testing in today's world is social comparison. Social comparison is the process of comparing oneself to others, especially in areas such as body image, abilities, and skills, to evaluate personal worth (7). Upward social comparison involves comparing oneself to someone perceived as superior, downward social comparison involves comparing oneself to someone perceived as inferior, and lateral social comparison involves comparing oneself to someone perceived to be at the same level (8,9). The relationship between social comparison and its impact on our daily lives is a reciprocal cycle – the influence on our everyday lives increases our tendency to engage in comparisons, which consequently alters how we live our lives (7). The implications of increased comparison include a harsher attitude towards one's abilities and a more favorable image of others' abilities caused by feelings of inadequacy or a lack of motivation (7). This can create healthy competition in some cases but intense anxiety in others (10).

Often, social comparison is one of the only ways we can evaluate our thoughts, opinions, and actions, and this causes us to surround ourselves with people we would like to emulate (11). This is especially seen in adolescents, where around 75% of teenagers aged 13-18 identify their peer group as one that challenges them, intellectually as well as socially (12). Comparing themselves to peers, especially those with qualities they would like, allows them to strive for meaning and validates unknown thoughts and emotions (7). Moreover, people who are unsure of their situation, whether in social, educational, or occupational spheres, tend to engage in more social comparisons than their self-assured peers. Assuredness of one's situation is more commonly seen in older individuals than in younger individuals (10,12). Thus, the tendency to socially compare decreases across adulthood (13). Younger adults also highly value their sense of identity, which is something that sets them apart from their peers and something that may be formed by how they compare themselves to peers (11). Younger adults are more conscious of their peers' behaviors than older adults, and tend to mold themselves in a way that helps them to stand out rather than to fit in. While as much as 71% of adults aged 50–64 would rather blend in, only 42% of adults under 35 would do the same (14). This inclination to stand out could provide a strong

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incentive to socially compare.

The combination of standardized testing and high school as an academic setting can be a major source of frequent and strongly competitive social comparisons in adolescents. If the result of the comparison is negative, it can lead to negative consequences such as extreme demotivation and lowered self-esteem, especially in this academic setting (6). A central determinant of academic success, self-efficacy is defined as a significant measure of an individual's confidence through their belief in their abilities to achieve certain behaviors and skills (15). Research investigating the relationship between self-efficacy and students' academic performance has suggested a strong correlation between the two (15,16). Furthermore, there is some evidence that negative social comparisons could lead to reduced self-efficacy in an academic setting (17,18). Hence, comparisons to others with higher academic performance or achievements could negatively impact perceptions of self-efficacy. Therefore, we hypothesized that adolescents who receive feedback that they performed in the 10th percentile on a test would be associated with less self-efficacy compared to those who receive feedback that they performed in the 50th percentile. Percentile scores are typically used to measure competence on these standardized tests. We decided to use them because they provide a direct measure for one's score in relation to others' scores, making subsequent social comparison inevitable and thus easily measurable after the percentile score is provided.

Similarly, unfavorable upward comparisons could be associated with decreases in positive expectations about future performance (19). Such negative effects may in turn reduce academic performance. Social comparisons are frequent in academic settings and used by students to assess their own performance by comparing it to their peers (20). Hence, we also hypothesized that adolescents who receive feedback that they performed in the 10th percentile on a test would have a more negative perception of their test performance on a subsequent test compared to those who receive feedback that they performed in the 50th percentile. Additionally, we expected that adolescents who receive feedback that they performed in the 10th percentile on a test would perform worse on a subsequent test compared to the first test than those who receive feedback that they performed in the 50th percentile.

Research has shown that adolescents – teenagers between 14 and 19 years of age – experience much more drastic decreases in self-esteem and increases in additional stress than those at any stage of adulthood (21). Because of the biological and environmental factors governing such a behavioral change, it may be worthwhile to consider that those in this age group will harbor different incentives to socially compare and thus experience comparison effects more severely (22). These factors include a more emotional outlook of oneself due to an increase in amygdala activity and a still-developing prefrontal cortex which decreases rational thinking and decision-making (22). Environmental factors include the instability created by constant peer and parent pressure that adolescents often face regarding major decisions for their future, such as higher education (3).

Previous research has shown that situational comparison and the roles of neurobiological factors may play a role in adolescent stress levels, yet evidence is lacking for these effects (22,23). For example, many studies focus only on adult samples (23,24). In general, these investigations rarely address the relationship between age and intensity of social comparison effects in a standardized test setting. On the other hand, adolescents are more familiar with standardized testing, potentially desensitizing them to effects of social comparison. However, because their scores on such tests have implications for their professional future, adolescents tend to hold standardized tests in much higher importance than adults (25). Additionally, neurobiological differences between adolescents and adults may contribute to a significant difference in each age group's outcomes to social comparisons with peers (22). We therefore hypothesized that the association between feedback that participants scored in the 10th or the 50th percentile and their test score difference is more negative for adolescents than for adults. In addition, the association between feedback that participants scored in the 10th versus the 50th percentile and one's self-efficacy as well as the perception of one's test score is more negative for adolescents than for adults.

Therefore, we analyzed the effects of upward versus lateral social comparisons in adolescents versus adults by reporting faux standardized test results to study participants and assessing the performance difference in a subsequent test. We compared these results to responses to survey questions inquiring about test anxiety, perceived competence, and self-efficacy for both age groups. We found that adolescent and adult self-efficacy after upward social comparison was not significantly different, but adolescent perceived test performance after upward social comparison was significantly less than adult perceived test performance after upward social comparison. We also found that though adolescent and adult test performance after upward social comparison was not significantly different, adolescents did perform significantly worse after the comparison than adults did. Our findings indicate that standardized testing impacts students' perceptions of their own performance, which has relevant implications for the future of standardized testing as well as the future of student self-esteem and academic performance.

RESULTS

We measured self-efficacy, perceived test performance, and actual test performance of both adolescents and adults in a standardized test setting after upward and lateral social comparison. We aimed to better understand the effects of standardized testing on students by comparing them to adults in order to determine the impact of standardized testing. We administered two shortened SAT exams as well as a follow-up survey inquiring into perceived test performance and self-efficacy to 50 adolescent and 50 adult participants. For each participant, we calculated and recorded the difference between their test scores, their perceived test performance score (as Likert rankings), and their General Self-Efficacy scale score.

The data we collected consisted of the differences between each participants' scores on the two administered tests, the participants' rankings of three perceived competency statements on a survey, and their rankings of six self-efficacy statements on the same survey. To analyze the data, we averaged the three rankings of perceived competency into a mean index of perceived competency, and we summed the rankings of the self-efficacy statements into a general

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self-efficacy scale score. We then calculated correlation coefficients to compare the results from each parameter between experimental conditions and used Fisher Z transformations to compare the results from each parameter between age groups.

We compared the correlations between the presence of upward social comparison and our three measured variables: self-efficacy, the difference in perceived competency scores, and the change in performance. The presence of upward social comparison refers to the presence of feedback stating that one scored lower as compared to their peers. The correlation here is between the binary variable of social comparison (present: 1 or absent: 0) and the self-efficacy score, difference in perceived competency scores, or the change in performance. For example, if the self-efficacy score decreases when comparison is present, there would be a negative correlation. There was no significant correlation between self-efficacy and the presence of upward social comparison in adolescents (p = 0.16). However, there was a non-significant negative correlation in adults (**Figure 1**). To test whether the two associations are different between adolescents and adults, we conducted a Fisher Z-test. The test does not indicate a significant difference in the relationship between the correlations in adults and adolescents (z = -1.41, p = 0.16).

Furthermore, there was a significant negative correlation between the difference in perceived competency scores and the presence of upward social comparison in adolescents ($r(48)$ = -0.557, p < 0.001). This correlation indicates a decline in adolescents' perceived competency at the standardized test after receiving a low score percentile. There was a significant positive correlation in adults ($r(48)$ = 0.747, p < 0.001) (**Figure 2**). The correlations between negative feedback and perceived performance are significantly more negative in adolescents than in adults (z = -3.36, p < 0.001). These two correlations indicate a significant difference between the correlations in adolescents and adults, which means that the adolescents

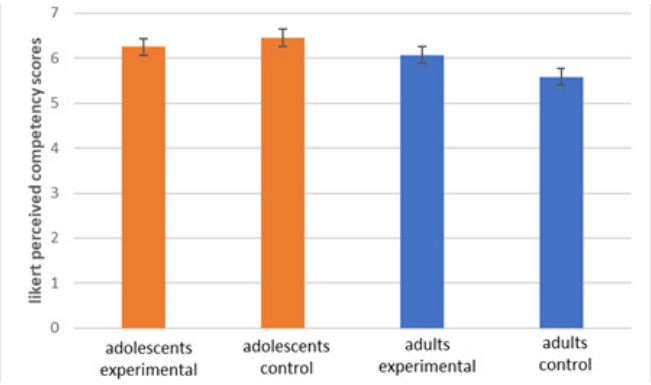

Figure 2. Perceived competency scores show a significant difference in correlations between adolescents and adults. Perceived competency (survey score) as a function of the presence of upward social comparison in adolescents (orange, n = 50) and adults (blue, n = 50). Experimental represents upward social comparison using 10th percentile feedback and control represents lateral social comparison using 50th percentile feedback. Data shown as mean perceived competency score ± standard error. The difference between the two correlations in adolescents versus in adults is significant (Fisher's z-test of differences in correlation: z = - 3.36, p < 0.001).

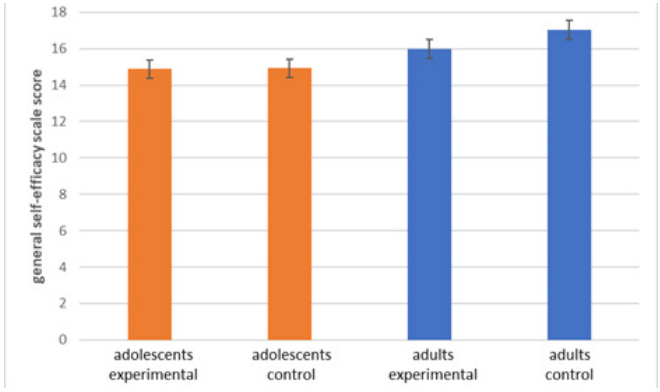

Figure 1: Self-efficacy levels show no significant difference in correlations between adolescents and adults. Self-efficacy level (general self-efficacy survey score) as a function of the presence of upward social comparison in adolescents (orange, n = 50) and adults (blue, n = 50). Experimental represents upward social comparison using 10th percentile feedback and control represents lateral social comparison using 50th percentile feedback. Data shown as mean self-efficacy level ± standard error. The difference between the correlations in adolescents versus in adults is not significant (Fisher's z-test of differences in correlation: z = - 1.41, p = 0.16).

expected that they scored significantly worse on the second test after being exposed to negative feedback for the first test than adults.

There was also a significant negative correlation between change in performance between the first and second tests and the presence of upward social comparison due to receiving the lower score in adolescents ($r(48)$ = -0.585, p < 0.001) (**Figure 3**). There was no significant correlation between the two in adults ($r(48)$ = 0.039, p = 0.790) (**Figure 3**). These two correlation values indicate a decline in adolescent test scores after receiving a low score percentile while the adults' test scores did not change significantly. The test for differences between the correlation coefficients indicates that the difference in test performance between adolescents and adults was not significant (z = -1.49, p = 0.14).

DISCUSSION

Our results supported some of our hypotheses. We expected to find that adolescents who receive feedback that they performed in the 10th percentile on a test would be associated with less self-efficacy compared to those who receive feedback that they performed in the 50th percentile. The data do not support our prediction as no such association was found. We also expected feedback and test score difference to have a stronger negative correlation in adolescents than adults, but since adolescents did not report significantly lower self-efficacy levels than adults, our prediction is not supported. We expected that adolescents who receive feedback that they performed in the 10th percentile on a test would have a more negative perception of their test performance on a subsequent test compared to those who receive feedback that they performed in the 50th percentile, and the data support our prediction. We also expected that the association between feedback that participants scored in the 10th versus the 50th percentile and the perception of one's test score would be more negative for adolescents than for adults. This prediction was supported by the data. We expected that adolescents who receive feedback that

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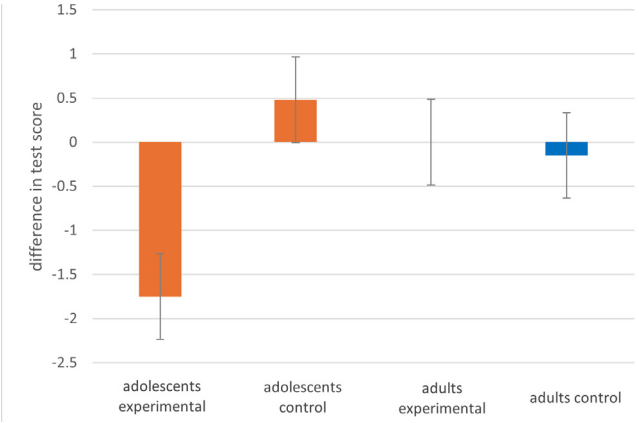

Figure 3. Competency levels show no significant difference in correlations between adolescents and adults. Competency (difference in test score) as a function of the presence of upward social comparison in adolescents (orange, n = 50) and adults (blue, n = 50). Experimental represents upward social comparison using 10th percentile feedback and control represents lateral social comparison using 50th percentile feedback. Data shown as mean test score difference ± standard error. The difference between the two correlations between adolescents versus in adults is not significant (Fisher's z-test of differences in correlation: z = - 1.49, p = 0.14).

they performed in the 10th percentile on a test would perform worse on a subsequent test compared to the first test than those who receive feedback that they performed in the 50th percentile, and this prediction was supported. We expected that the association between feedback that participants scored in the 10th versus the 50th percentile and self-efficacy would be more negative for adolescents than adults, and because this did not indicate a significant difference between the correlations in adolescents and adults, our prediction was not supported.

By conducting this study, we sought to determine the relationship between types of social comparisons and changes in test performance, perceived test performance, and self-efficacy in adolescents and adults in a standardized test setting. After obtaining data from 50 adolescent and 50 adult participants we found that adolescents did not report significantly lower self-efficacy after an upward comparison (i.e., receiving the low score) as compared to adolescents who only compared laterally (i.e., receiving the median score). We also found that adolescents performed worse and perceived their performance as worse after engaging in upward comparison as compared to adolescents who only engaged in lateral comparison. Competency and self-efficacy level did not have significantly different associations with comparison type between adolescent and adult age groups. However, the difference in the correlation between age groups for perceived competency was statistically significant, indicating that adolescents experience a more negative impact on their perceived performance than adults.

The study has three main limitations that were not accounted for in the design of the study. First, the feedback may be more or less believable to students and adults based on beliefs of their own performance and competency. It is possible that the 10th percentile score was less believable to some test-takers who usually perform well and vice versa. Furthermore, the situation in an experiment is likely different for a real-life standardized test setting, as underperforming in a real standardized test setting is likely to have negative consequences in individuals' lives, whereas a laboratory setting is not. Secondly, results may not be generalizable to everyone, as the experiment was only conducted in one area and the study relied on voluntary participation, which may have induced a selection bias. Additionally, the sample size was 50 participants per age group, which may not be sufficient to detect small effects. Lastly, as the percentiles were not normalized to the participants' real performance, variation in their reactions to being told they scored in the 10th or 50th percentiles could have occurred. This may have skewed the resulting perceived competency and self-efficacy measures, since these would be different for someone told they scored in the 10th percentile who normally scores in that range versus someone who typically scores higher. Future studies should account for these limitations – for example, this may be done by generalizing the study to include larger, nationally-representative samples as well as other standardized tests like the ACT or more extensive assessments like a full SAT examination. Though we only used the measure of test anxiety in order to obfuscate the purpose of the study, it could present further implications regarding standardized testing and is therefore a variable of interest for future studies.

Adolescents felt they performed worse after receiving the lower score. This is in line with previous research that shows that adolescent neurobiology is much more unstable, and they are more prone to quick conclusions and emotions, especially regarding themselves (22). However, we found similar results in self-efficacy and actual test performance between adolescents and adults after upward social comparison. This could mean that these factors are not affected by social comparison to the same extent as others such as emotional responses or perceived test performance. However, the effect of the comparison on these factors could also be too small to detect with 50 participants per group. Therefore, larger experiments are needed to investigate these relationships further. While some of the expected negative effects did not occur, as proposed by criticism of standardized testing, perceived test performance was more negatively affected after unfavorable comparisons in adolescents shows that negative consequences of standardized testing exist (25). Furthermore, negative perceptions of one's own performance may have negative implications in the future (e.g., an impact on self-esteem) (24). Additionally, the findings from this literature as well as our results show that for adolescents, SAT-like tests may be much more important than for adults (25). Thus, they could feel discouraged after getting a low score and worry about doing well when it matters.

From the competency results, we can assume that adolescents are affected more by receiving feedback that they performed worse than most others, as they may try less and subsequently perform worse on the second test. Adults, on the other hand, perform similarly. Again, because the SAT is less meaningful to them and their perception of success, they may try equally as hard no matter where they perceive themselves in relation to others. The association between feedback type and actual test performance shows that adolescents perceive their performance in a second test as worse and perform worse after an unfavorable comparison to others. Adults perceive their performance as better after the lower score, potentially because they could now be motivated to do better and may be more able to develop

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strategies for improved test performance instead of focusing on the outcome. For the self-efficacy results, there was no significant effect of receiving negative feedback. This could be due to methodological limitations. If negative feedback does not affect self-efficacy in adolescents, this would be highly adaptive because they may not let negative feedback affect their perceptions of their capabilities. Adults' self-efficacy was similarly not impacted by the negative feedback.

Overall, while some of our hypotheses were not supported, the present study shows the potential of unfavorable social comparisons due to standardized testing to impact students' perceptions of their own performance. This has relevant implications for the future of standardized testing as well as the future of student self-esteem and academic performance – realizing the consequences of standardized testing as they relate to students is vital for implementing the most up-to-date policies regarding college and university admission. Because of the potential of standardized tests to demoralize students, studies on these tests' validity coupled with studies on their consequences should point in the right direction considering student benefit and measures that truly indicate college readiness.

MATERIALS AND METHODS

Participant Recruitment

To recruit adolescent participants, a random selection of 100 students at three high schools were emailed about participation in the study. We contacted more potential participants to obtain the target sample size of 50 adolescents to account for participants who do not sign up for the study. Adolescent participants were asked if they were in the 14-18 age range and if they would like to participate. They were informed that they would take two shortened versions of the SAT and a follow-up survey, as well as how they would receive their test results. They were given a signup form and an informed consent form as well. A flyer with the same information about the study and a QR code with a link to the signup and informed consent forms were distributed around the three high schools, local businesses, and a public library. Adults, defined as individuals over the age of 18, were recruited with a similar flyer adapted for their demographic, placed in the same locations as the flyer for adolescents. Once 50 responses were received for each age group, each participant was randomly assigned to one of the experimental conditions. This resulted in half of the adolescents and adults being assigned to the experimental group and the other half being assigned to the control group.

Experimental Design

A double-blind procedure was employed in a standardized test setting modeled after the SAT. The test was administered to adolescents from three northwestern US high schools and adults in the same area. After the first test, participants in the control group received feedback that they scored average on the test (50th percentile). Participants in the experimental group received feedback that they scored low on the test compared to others (10th percentile). The test was then administered a second time and the test scores and the differences in scores were recorded, as well as responses to a survey inquiring into perceived competency, self-efficacy, and test anxiety. To obfuscate the purpose of the study, the measurement of test anxiety was included within the methodology.

Test Creation

To create the two standardized tests, two ten-question multiple-choice exams were created, with five reading comprehension questions and five arithmetic/algebraic math questions per exam. These questions were adapted from SATs from previous years released on the CollegeBoard website (26). Since the SAT progresses from easier questions to more difficult questions, the material for the adapted tests were taken from the beginnings of each section to control difficulty. The same two tests were administered to the experimental and control groups of both the adolescent and adult age groups. Standard bell curves were created in Microsoft Excel to illustrate the manipulated results. One highlighted a result in the 10th percentile of test takers (the upward social comparison/negative feedback condition), and one highlighted a result in the 50th percentile (the lateral comparison/neutral feedback condition). The visual representation was included to allow for more credibility regarding the fake results administered to the participants, allowing them to view their score in a format similar to the SAT score representation. Furthermore, the image should make it easier to understand where a participant performs compared to others.

Test Administration

To administer the tests to the experimental and control populations of both age groups, the 100 prospective participants were emailed with a time and place to take the multiple-choice test, as well as a list of items to bring (calculator, water, etc.). A confederate, whose behavior was rehearsed prior to the experiment, was employed to administer the test and give the manipulated feedback. The confederate provided each of the participants with a number two pencil and a copy of one test. The participants sat side-by-side while taking the test and were given fifteen minutes to complete. They were reminded when half the time was remaining and again when there were two minutes left. The confederate then collected the test forms and scored them using the scantron system, recording the scores of each participant. Then, the distribution curves representing a result in the 10th percentile of test takers were emailed to the experimental group participants, and the distribution curves representing a result in the 50th percentile of test takers were emailed to the control group participants. The confederate was not aware of which feedback the participants received. The confederate then administered the second test, giving the participants 15 minutes to complete and reminding them when half the time was remaining and when there were two minutes left. The scores were once again recorded in the same manner. The two scores were collected because we aimed to assess changes in performance; the data used for analysis was the difference between the score on the first test and second test.

Survey Administration

To administer the survey inquiring into perceived competency and self-efficacy, Google Forms was used. The form provided feedback with a text box and image that appeared at the beginning, reminding the participants that they scored in the 10th percentile of test takers. After this text box, participants were asked to rank the declarative

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statements provided by the Westside Test Anxiety Scale – this measure was included to obfuscate the study's true purpose (27). Participants' scores were recorded in each group in the corresponding data tables. Next, the declarative statements "I feel I am competent at the material on the test administered today," "I feel I can complete this test again and receive a better score," and "I feel my skills and capabilities align with my capacity to earn a high score on this test" were presented (based on survey questions from prior literature (10)). A Likert-type scale was presented under each statement on which the participants ranked how much they agreed with the statements from zero (completely disagree) to ten (completely agree). The mean of the three items was averaged into an index of perceived competency. After this, participants were presented with a modified version of the Generalized Self-Efficacy Scale (GSE), which involves ranking ten declarative statements according to their resonance with an individual. Declarative statements included items such as "it is easy for me to stick to my aims and accomplish my goals", and participants ranked each statement from zero (not at all true) to four (exactly true) (28). To reduce the duration of the study, only the first to third and sixth to eighth items of the original scale were included – participants were given only these six items. Participants' rankings of each statement were summed to calculate their GSE score. The participants' GSE scores were recorded in each group in the corresponding data table. A copy of this survey was made, in which the text box and image at the beginning reminded the participants that they had instead scored in the 50th percentile of test takers. The first survey (10th percentile) was distributed to the experimental group and the copy of the survey (50th percentile) was distributed to the control group right after they took the test. To analyze the data, R was used to separately calculate correlation coefficients within the age groups (adolescents and adults) (29). They were then Fisher Z transformed before the z-value and the corresponding p-value were computed. The formula for these calculations is described in **Equation 1** (30). The correlation coefficients between experimental and control group were coded binarily (control/lateral comparison group = 0, experimental/upward comparison group = 1).

$$Z1 = 0.5 * \log(\frac{1+r1}{1-r1})$$

$$Z2 = 0.5 * \log(\frac{1+r2}{1-r2}) \qquad \text{(Eqn. 1)}$$

$$z = \frac{(Z1-Z2)}{\sqrt{\frac{1}{n1-3}+\frac{1}{n2-3}}}$$

The participants were debriefed one day after the experiment through email, informing them of the purpose of the study and that the feedback was not based on actual performance, as well as how each of the tasks they were asked to perform aided in forming a conclusion about the effects of upward social comparison.

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