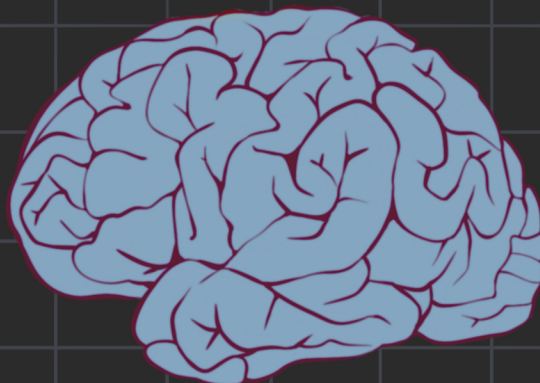


# Journal of Secondary Psychological Studies

Volume 4 Issue 1

2022



# Table of Contents.

Living in a Twenty-First Century Virtual Reality: The Effect of Virtual Backgrounds on Perceived Intelligence and Approachability of Video Conferencing Software Users

*Hanah Youn* Pg. 1

Here Comes the Sun: The Effect of Solar Panel Placement on Perceptions of Houses

*Eli Weseley-Jones* Pg. 8

The Impact of COVID-19 on Students' Academic Motivation

*Tracy Gold* Pg. 14

The Effect of Genetically Modified Labeling of Plant and Animal Products on Consumer Perceptions

*Emily Yeh* Pg. 24

## Staff.

### Editors in Chief

Tarini Mutreja

Hailee Youn

### Content Editors

Sam Jacobson

Jake Ramsey

Arya Sinha

Julia Weingarten

### Copy Editors

Brandon Shintani

### Cover Designer

Amelia Abraham

# Letter from the Editors.

Dear Readers,

The editorial board of the *Journal of Secondary Psychological Studies* is proud to present the first issue of the fourth volume of our publication. We feel extremely fortunate to have had the opportunity to work with our incredible staff and authors who have worked tirelessly at every stage of the editorial process to produce a quality issue.

Despite the continued challenges caused by the COVID-19 pandemic, our goal was to shed light on important findings in the field of psychology and foster a greater appreciation for empirical research. As such, we were delighted to receive more submissions than ever before, and those came from a diverse array of high schools across the country and the world. The journal took feedback to the next level, with our editors implementing new strategies of providing feedback to authors and the journal now publishing bi-annually to offer more opportunities for high school students to publish their psychological research.

This edition highlights a variety of fascinating subjects from the impact of virtual backgrounds on perceptions of intelligence to how the presence of a solar panel may shape perceptions of housing. We are hopeful that this publication will not only enlighten students across the world, but also empower them to join their peers in discovering new facets of psychological research. After all, research is taking action: searching for answers and marching into the scientific unknown.

Tarini Mutreja and Hailee Youn

Editors in Chief

# Living in a Twenty-First Century Virtual Reality: The Effect of Virtual Backgrounds on Perceived Intelligence and Approachability of Video Conferencing Software Users

Hanah Youn, Roslyn High School

younhanah@gmail.com

## Abstract

Previous studies have suggested that it is within human nature for people to seek approval from their peers (Formica, 2014; Hoffman et al., 2015). Now that the COVID-19 pandemic has shifted education and work to virtual platforms, people demonstrate a yearning for approval through curating virtual backgrounds (Burnell, 2020). Accordingly, the present study investigated the effect of virtual backgrounds on the perceived intelligence and approachability of video conferencing software users. Participants (N=218), who were all high school students, were randomly assigned to view a photograph of either a female teenager or a male teenager with one of three virtual backgrounds: a bookshelf background, a solid blue background, or a solid red background. Then, participants rated the perceived intelligence and approachability of the individual that was presented. As hypothesized, the solid blue background led to higher approachability ratings as compared to the solid red background ( $p < .05$ ). Interestingly, males were perceived as marginally more intelligent ( $p = .064$ ) and significantly more approachable ( $p < .02$ ) than females. However, neither the bookshelf background nor the solid colored backgrounds affected the perceived intelligence of the individual in the photograph ( $p = .18$ ). In application to the current “virtual world” in which we are living, the results suggest that it may be beneficial to employ a solid blue background when attempting to seem more approachable, whereas utilizing a solid red background when trying to appear more intimidating.

Keywords: virtual background, perceived intelligence, perceived approachability, gender norms

## Introduction

New times call for new measures, and the global pandemic we are currently facing is not an exception. As a result of COVID-19, education and the workplace have shifted to a virtual atmosphere via video conferencing software platforms. Nearly 93% of households with school-aged children report some form of distance learning (McElerath, 2020), with the most popular

conferencing software platform being Zoom Video Communications in 2020 (Columbus, 2020). It is a commonly held belief that people care about how others perceive them (Rose, 2019). This sentiment persists in online settings as well, albeit is expressed in slightly different ways than in person. For instance, users of online platforms may utilize filters and virtual backgrounds to enhance their portrayal (Burnell, 2020; Meyer, 2020). Hence, the present study explored how one’s virtual

background affects perceptions of an individual's intelligence and approachability.

Previous studies suggest that a bookshelf background is perceived as the balance between personal and professional. According to McCracken (1981), a person's personality is revealed through simply observing their bookshelves, giving off a more intelligent perception of that individual. This phenomenon is known as the bookcase flex, where books are related to an individual's expression of learning and knowledge (Mohammed, 2020). These ideas have led to the idea of the "credibility bookshelf." With intentions of establishing their credibility and forming perceptions of intelligence, politicians, company executive officers, and television hosts have employed bookshelf backgrounds across virtual platforms (Hess, 2020). These ideas regarding intelligence are untested assertions which are why this study sought to determine whether bookshelf backgrounds make an individual perceived as more intelligent, as compared to other virtual backgrounds.

Along with a bookshelf background, one of the most commonly used virtual backgrounds is solid color backgrounds, as they are recommended by Zoom Video Communications (Scripps Research, n.d.). Research reveals that the colors red and blue stimulate extremely opposite psychological cues (Manning, 2009). Red elicits generally negative and danger-bearing emotions, while blue elicits generally positive and secure emotions (Cherry, 2020; Elliot, 2015; Gremillion, 2019). While the color blue triggers a perception of calmness, knowledge, and credibility (Crick, 2019; Ferreira, 2019; Wolchover, 2012), red elicits the opposite. These disparate emotions that may be evoked from the red and blue backgrounds pose a question concerning how one's background can determine an individual's perceived approachability. Danger-bearing emotions make an individual perceived as relatively less approachable, whereas calm and secure emotions make an individual perceived as relatively more

approachable (Elliot et al., 2015; Ilie et al., 2008; London Image Institute, 2020). Since the colors red and blue are opposites on the visible light spectrum and elicit an opposite range of emotions, it is worthwhile to test the effect of red and blue solid colored virtual backgrounds on perceived approachability.

Furthermore, research has also demonstrated that females and males are perceived differently in real life: males are generally perceived to be more intelligent than females (Szymanowicz & Furnham, 2013; Rammstedt et al., 2000; Steinmayr et al., 2009; Storek, 2011). This is supported by the gender-brilliance stereotype, where people associate high levels of intelligence with men as compared to women (Storage et al., 2020). However, the toxicity of this stereotype transcends strictly women and men as it further impacts the perceptions and interests of impressionable children. In particular, due to gendered notions of brilliance, 6-year-old girls had a proclivity of avoiding activities they believed were exclusively for "really, really smart" children (Bian et al., 2017). These results suggest that gender-brilliance stereotypes regarding cognitive ability are acquired early on and can influence future occupational aspirations (Bian et al., 2017; Cimpian et al., 2015; Ertl et al., 2019; Leslie et al., 2015).

Moreover, these social constructs are heavily intertwined with the Field-specific Ability Beliefs (FAB) Hypothesis (Meyer et al., 2015). This hypothesis proposes that the combination of field-specific ability beliefs (belief that success in a field relies on raw ability or aptitude) and cultural stereotypes of gender and ability (belief that men are more likely than women to possess raw ability or aptitude) leads to gender gaps in academia (women are underrepresented in fields that emphasize the need for raw ability or aptitude rather than effort). When this hypothesis was tested, the results suggested that biases affiliating the science-related occupations with "brilliance" are pervasive in the modern era and may explain

female underrepresentation in STEM (Deiglmayr et al., 2019; Meyer et al., 2015). See appendix for diagram.

Considering that past research has shown that males are generally perceived as more intelligent than females, observing whether this notion holds across a virtual environment is valuable insight. As a result, it would be essential to test whether different virtual backgrounds may exacerbate or mitigate this phenomenon.

This study explored the differences in perceived intelligence and approachability across different genders and backgrounds, testing the following hypotheses: [1] compared to a female video conference user, a male video conference user will be perceived as more intelligent; [2] compared to a video conference user with a solid color background (red and blue), a video conference user with a bookshelf background will be perceived as more intelligent; [3] compared to a video conference user using a solid red background, a video conference user using a solid blue background will be viewed as more approachable.

## Methods

### *Participants*

Participants were recruited from high school mathematics classes at a mid-sized northeastern high school in the United States given that previous studies have only measured differences in perception of intelligence and approachability across adult males and females and children under the age of eight. A survey measuring the effect of different virtual backgrounds on perceived intelligence and approachability was administered to potential participants; participants had a time window of 36 hours to respond. However, the participants were not aware of the precise premise of the study, as a means to avoid participant biases. At the beginning of the survey, potential participants signed an informed assent form which provided information

about the study. Out of 239 participants who completed the survey, 218 participants passed the manipulation check and became a part of the study.

In the final group of 218 participants, there was a relatively even split between females (112) and males (106). The race composition was relatively diverse as well, with White participants (65.6%), Asian participants (23.4%), Hispanic or Latinx participants (6.4%), Black or African American participants (2.3%), American Indian or Alaska Native participants (1.4%), and participants who identified as “other” (0.9%). The average age of participants was 15.2 years old and ranged from 14 to 18 years old.

### *Experimental Stimuli*

The current study compared six conditions (two levels of the gender independent variable and three levels of the background independent variable): a female presenter with a bookshelf virtual background, a male presenter with a bookshelf virtual background, a female presenter with a solid red virtual background, a male presenter with a solid red virtual background, a female presenter with a solid blue virtual background, and a male presenter with a solid blue virtual background. To avert the presence of extraneous variables, hairstyle, clothing, facial expression, posture, and age were consistent between the conditions--the male and female (ages 14) were presented with short, curly brown hair, wearing a black shirt, with an even facial expression, and straight posture. Additionally, the experimental stimuli were presented with a vertical aspect ratio as they were headshot photographs. Participants were randomly assigned to see one of the six conditions and prompted to respond to the items of the survey, shown in the appendix. The software platform, Qualtrics, was utilized to create the survey and randomly assign participants to see one of the six conditions.

### Dependent Measures

This study measured two dependent measures: perceived intelligence and perceived approachability. The survey consisted of 10 total items: 5 questions measured the construct of perceived intelligence, and 5 questions measured the construct of perceived approachability. All items were measured on a 5 point Likert scale ranging from “Strongly Disagree,” to “Strongly Agree,” with the additional option of “Prefer not to answer.” The intelligence scale was adopted from an earlier study (Patterson et al., 2016) and reflected strong internal reliability with a Cronbach’s Alpha value of 0.85. In addition, the approachability scale was adopted from a previous study (Montepare et al., 2014) and reflected strong internal reliability with a Cronbach’s Alpha value of 0.84 (all items from both scales were utilized). See appendix for items.

Subsequently, participants completed a manipulation check, asking them “What background did that person use?” and “What was the gender of that person?” to ensure that participants were aware of this information when completing the survey. If participants failed to answer the manipulation checks correctly, they were not included in the data analyzed. Questions following the manipulation check asked for participants’ demographics: gender, age, and race.

### Design and Procedure

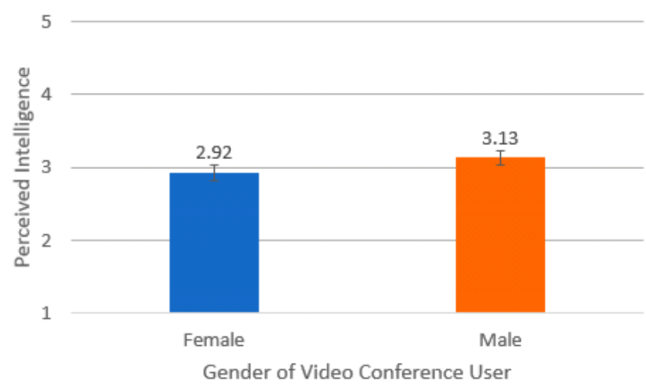
The design of the study was a 3 (Virtual Background: red, blue, bookshelf) x 2 (Gender of Video Conference User: female, male) between-subjects full factorial design (see appendix). Participants were presented with an informed assent form and then were randomly assigned to view one of the six conditions of the experimental stimuli. After being presented with the condition, they had to respond to the rest of the survey evaluating their perceptions of intelligence and approachability of video conference users. The

results were collected and then downloaded into SPSS Statistics Software for data analysis.

## Results

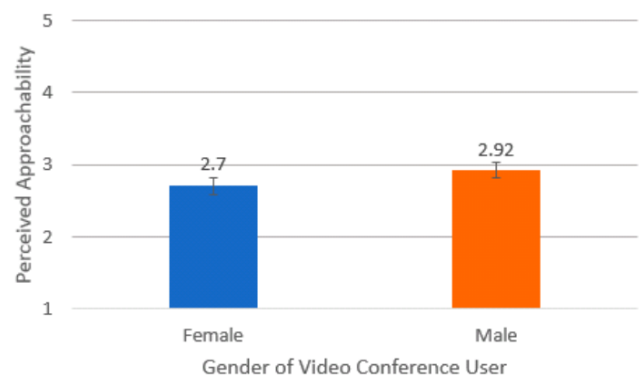
### Gender

The study’s first hypothesis on perceived intelligence across different genders was not supported by the data set. Figure 1 shows how males were perceived as only marginally more intelligent than females and consequently these results could be due to chance. As a result, these results were not statistically significant,  $F(1, 215)=3.47, p=.064$ .



**Figure 1. Differences in Perceived Intelligence Between Females and Males**

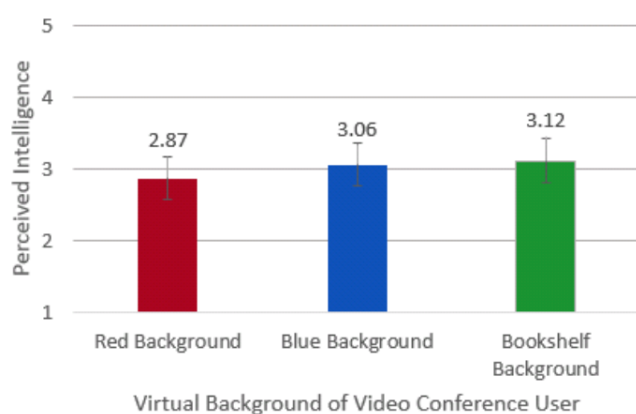
Furthermore, although this finding was not originally hypothesized, the results revealed that there was a significant difference in perceived approachability across females and males  $F(1, 203)=5.83, p<.02$ . Figure 2 demonstrates how males were perceived as significantly more approachable than females, across all backgrounds.



**Figure 2. Differences in Perceived Approachability Between Females and Males**

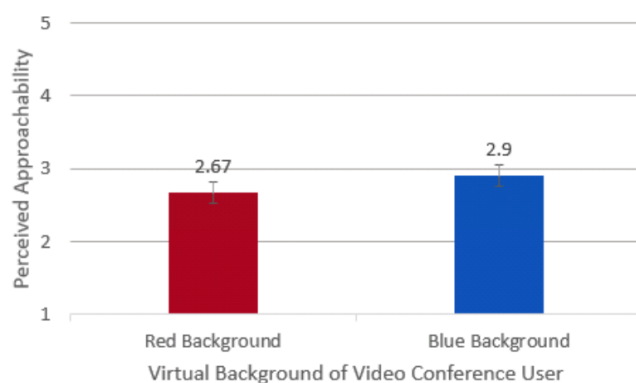
### Virtual Background

The study's second hypothesis on the effect of virtual backgrounds on perceived intelligence was supported by the data. As shown in Figure 3, individuals who used a bookshelf background were perceived as the most intelligent, followed by the solid blue, and solid red background, respectively. However, the virtual backgrounds did not have a significant main effect on perceived intelligence,  $F(2, 215)=1.73, p=.18$ .



**Figure 3. The Effect of Virtual Backgrounds on Perceived Intelligence**

Additionally, the solid-colored virtual backgrounds had a significant main effect on the perceived approachability of video conference users,  $F(2, 203)=2.14, p<.05$ . The means displayed in Figure 4 (2.67 and 2.9) support the third hypothesis and demonstrate that the individuals who used the solid blue background were perceived as significantly more approachable than individuals who used the solid red background.



**Figure 4. The Effect of Solid-Colored Backgrounds on Perceived Approachability**

### Discussion

#### Gender

The lack of differences in perceived intelligence between females and males might be an indication that gender norms are changing as time progresses. In the past, sexism has been a pervasive issue (Ananthaswamy & Douglas, 2018), where males were generally perceived as more intelligent than females (Szymanowicz & Furnham, 2013). In the modern era, these notions and norms may be changing—females may be perceived as equally intelligent as males.

In addition, the results revealed that males were perceived as more approachable than females. Despite efforts to control hairstyle, clothing, facial expression, and posture, it is possible that the male presented in the experimental stimuli may have seemed naturally more approachable than the female. Also, female teenagers may be perceived as less approachable than male teenagers given the fact that females mature earlier, and ergo may look more serious, and less approachable (Bergland, 2013); the female in the experimental stimuli may have appeared to be more mature than the same-aged male and thus could have seemed more serious and less approachable.

#### Virtual Background

Moreover, an individual using the solid blue-colored background was perceived to be more approachable in comparison to when using the solid red-colored background. This finding is likely since the color blue elicits feelings of calmness, knowledge, and credibility (Crick, 2019; Ferreira, 2019; Wolchover, 2012), while the color red elicits opposite psychological cues—generally danger-bearing emotions (Cherry, 2020; Elliot, 2015; Gremillion, 2019). As a result, the red background could have been perceived as more intimidating, and therefore, less approachable.

Additionally, past studies have established that as people mature, people prefer colors of



shorter wavelengths—blue, green, violet—rather than colors of longer wavelengths—red, orange, yellow—according to Birren in 1950 (Tate Design, 2013). This may explain why the blue virtual background was perceived as more approachable given that the teenage participants of this study are in the stage of maturation into adulthood and could have preferred colors of shorter wavelengths.

Furthermore, there was no significant effect of virtual backgrounds on perceived intelligence. A possible reason for this finding may be that participants taking the survey were more focused on the video conference user that was presented in the photograph, rather than the background itself.

### *Limitations and Further Study*

This study is notable as it was one of the first to examine the collective effects of different virtual backgrounds (including colors and non-colors) on an individual's perceived intelligence and approachability. However, a limitation of this study was that the survey was only distributed to a single northeastern high school's student population. Therefore, in future studies, it would be valuable to extend the distribution size and further investigate the demographic, temporal, and regional factors that may affect perceptions of intelligence and approachability. Additionally, another limitation was the age range of the sample (strictly high school adolescents between the ages of 14 and 18) and the restricted gender identifications (female and male) provided in the survey; as a result, further research can investigate the differences in perceived approachability and intelligence across larger age divisions and other identifications of the gender spectrum (i.e. non-binaries, gender fluids, androgynes, &c.). While this study focused on the solid red and solid blue colors, it would also be interesting to expand the range of solid colored backgrounds utilized. Examining the effect of different shades of colors or patterns could also be instrumental, as they may provide new insights.

In application to the perceptions of virtual backgrounds on web-conferencing platforms, the results of the present study suggest that it may be beneficial to employ a solid blue background when attempting to seem more approachable, whereas utilizing a solid red background when trying to appear more intimidating.

### **References**

- Ananthaswamy, A., & Douglas, K. (2018, April 18). The origins of sexism: How men came to rule 12,000 years ago. *NewScientist*. <https://www.newscientist.com/article/mg23831740-400-the-origins-of-sexism-how-men-came-to-rule-12000-years-ago/>
- Bergland, C. (2013, December 20). Scientists identify why girls often mature faster than boys. *Psychology Today*. <https://www.psychologytoday.com/us/blog/the-athletes-way/201312/scientists-identify-why-girls-often-mature-faster-boys>
- Bian, L., Leslie, S.-J., & Cimpian, A. (2017). Gender stereotypes about intellectual ability emerge early and influence children's interests. *Science*, 355(6323), 389-391. <https://doi.org/10.1126/science.aah6524>
- Burnell, B. (2020, April 24). The new authority on virtual meeting backgrounds is @ratemyskyperoom. NBC Boston. Retrieved February 2, 2021, from <https://www.nbcboston.com/news/coronavirus/twitter-ratemyskyperoom-interview/2113525/>
- Cherry, K. (2020, September 13). The color psychology of red. *Verywell Mind*. Retrieved January 7, 2021, from <https://www.verywellmind.com/the-color-psychology-of-red-2795821>
- Cimpian, A., & Leslie, S.-J. (2015). Response to comment on "Expectations of brilliance underlie gender distributions across academic disciplines." *Science*, 349(6246), 391. <https://doi.org/10.1126/science.aaa9892>
- Color psychology: How do colors affect mood & emotions? (2020, February 5). London Image Institute. Retrieved January 5, 2021, from <https://londonimageinstitute.com/how-to-empower-yourself-with-color-psychology/>
- Columbus, L. (2020, April 20). Which web conferencing software is the most popular with its users? *Forbes*. <https://www.forbes.com/sites/louiscolumbus/2020/04/20/which-web-conferencing-software-is-the-most-popular-with-their-users>
- Crick, S. (2019, November 3). How color affects emotions. Shelley Crick. Retrieved January 4, 2021, from <http://shelleycrick.com/how-color-affects-emotions/>
- Deiglmayr, A., Stern, E., & Schubert, R. (2019). Beliefs in "Brilliance" and belonging uncertainty in male and female STEM students. *Frontiers in Psychology*, 10. <https://doi.org/10.3389/fpsyg.2019.01114>
- Does age affect color preferences? (2013, November 22). Tate Design. Retrieved February 22, 2021, from

- <https://tatedesign.net/does-age-affect-color-preferences/>
- Elliot, A. J. (2015). Color and psychological functioning: A review of theoretical and empirical work. *Frontiers in Psychology*, 6. <https://doi.org/10.3389/fpsyg.2015.00368>
- Elliot, A. J., Fairchild, M. D., & Franklin, A. (2015). *Handbook of color psychology*. Cambridge University Press. <https://doi.org/10.1017/CBO9781107337930>
- Ertl, B., Luttenberger, S., Lazarides, R., Jones, M. G., & Paechter, M. (2019). Editorial: Gendered paths into STEM: disparities between females and males in STEM over the life-span. *Frontiers in Psychology*, 10. <https://doi.org/10.3389/fpsyg.2019.02758>
- Ferreira, N. M. (2019, May 31). Color psychology: How color meanings affect your brand. Oberlo. Retrieved December 29, 2020, from <https://www.oberlo.com/blog/color-psychology-color-meanings>
- Formica, M. J. (n.d.). Why we care about what other people think of us. *Psychology Today*. <https://www.psychologytoday.com/us/blog/enlightened-living/201412/why-we-care-about-t-what-other-people-think-us>
- Furnham, A., Hosoe, T., & Tang, T. L.-P. (2001). Male hubris and female humility? A crosscultural study of ratings of self, parental, and sibling multiple intelligence in america, britain, and japan. *Intelligence*, 30(1), 101-115. [https://doi.org/10.1016/S0160-2896\(01\)00080-0](https://doi.org/10.1016/S0160-2896(01)00080-0)
- Gremillion, A. S. (n.d.). How color impacts emotions: How colors make you feel. 99designs. Retrieved January 16, 2021, from <https://99designs.com/blog/tips/how-color-impacts-emotions-and-behaviors/>
- Hess, A. (2020, May 1). The 'credibility bookcase' is the quarantine's hottest accessory. *The New York Times*. <https://www.nytimes.com/2020/05/01/arts/quarantine-bookcase-coronavirus.html>
- Hoffman, M., Yoeli, E., & Nowak, M. A. (2015). Cooperate without looking: Why we care what people think and not just what they do. *Proceedings of the National Academy of Sciences*, 112(6), 1727-1732. <https://doi.org/10.1073/pnas.1417904112>
- Ilie, A., Ioan, S., Zagrean, L., & Moldovan, M. (2008). Better to be red than blue in virtual competition. *CyberPsychology & Behavior*, 11(3), 375-377. <https://doi.org/10.1089/cpb.2007.0122>
- Leslie, S.-J., Cimpian, A., Meyer, M., & Freeland, E. (2015). Expectations of brilliance underlie gender distributions across academic disciplines. *Science*, 347(6219), 262-265. <https://doi.org/10.1126/science.1261375>
- McCracken, D. (1981). Reading for pleasure: Known by your bookshelves. *BMJ*, 282(6257), 59-61. <https://doi.org/10.1136/bmj.282.6257.59>
- McElerath, K. (2020, August 26). Nearly 93% of households with school-age children report some form of distance learning during covid-19. United States Census Bureau. Retrieved February 7, 2021, from <https://www.census.gov/library/stories/2020/08/schooling-during-the-covid-19-pandemic.html>
- Meyer, M., Cimpian, A., & Leslie, S.-J. (2015). Women are underrepresented in fields where success is believed to require brilliance. *Frontiers in Psychology*, 6. <https://dx.doi.org/10.3389%2Fpsyg.2015.00235>
- Meyer, Z. (2020, June 23). Do you show your face in zoom meetings? Your gender may play a role. *Fast Company*. <https://www.fastcompany.com/90514033/do-you-show-your-face-in-zoom-meetings-your-gender-may-play-a-role>
- Mohammed, F. (2020, May 22). The timeless art of the bookcase flex. *JSTOR Daily*. Retrieved February 23, 2021, from <https://daily.jstor.org/the-timeless-art-of-the-bookcase-flex/>
- Rammstedt, B., & Rammsayer, T. H. (2002). Gender differences in self-estimated intelligence and their relation to gender-role orientation. *European Journal of Personality*, 16(5), 369-382. <https://doi.org/10.1002/per.454>
- Rose, H. (2019, June 22). Who do we constantly seek the approval of others? *Psychology Today*. <https://www.psychologytoday.com/us/blog/working-through-shame/201906/why-do-we-constantly-seek-the-approval-others>
- Scripps Research. Retrieved February 9, 2021, from <https://www.scripps.edu/covid-19/information/zoom-interview-best-practices/using-zoom-backgrounds.html>
- Steinmayr, R., & Spinath, B. (2009). What explains boys' stronger confidence in their intelligence? *Sex Roles*, 61(9-10), 736-749. <http://dx.doi.org/10.1007/s11199-009-9675-8>
- Storage, D., Charlesworth, T. E.s., Banaji, M. R., & Cimpian, A. (2020). Adults and children implicitly associate brilliance with men more than women. *Journal of Experimental Social Psychology*, 90, 104020. <https://doi.org/10.1016/j.jesp.2020.104020>
- Storek, J. S. (2011). The hubris and humility effect and the domain-masculine intelligence type: Exploration of determinants of gender differences in self-estimation of ability. *UCL Discovery*. Retrieved March 3, 2021, from <https://discovery.ucl.ac.uk/id/eprint/1331910/>
- Szymanowicz, A., & Furnham, A. (2013). Gender and gender role differences in self- and other-estimates of multiple intelligences. *The Journal of Social Psychology*, 153(4), 399-423. <https://doi.org/10.1080/00224545.2012.754397>
- Wolchover, N. (2012, June 29). Your color red really could be my blue. *Live Science*. Retrieved March 6, 2021, from <https://www.livescience.com/21275-color-red-blue-scientists.html>
- Zoom virtual backgrounds. (n.d.). 2009 IEEE International Professional Communication Conference (IEEE Staff, Comp.). (2009). Institute of Electrical and Electronics Engineers. <https://doi.org/10.1109/IPCC.2009.5208700>

# Here Comes the Sun: The Effect of Solar Panel Placement on Perception of Houses

Eli Weseley-Jones, North Shore High School

eweseleyjones@gmail.com

## Abstract

Greenhouse gases plague Earth's atmosphere, and by switching to solar power, humans can help to negate their effects. Many believe that people do not like the aesthetics of solar panels. This experiment tested how the presence and placement of solar panels affected perceptions of a house. To conduct the experiment, over 100 participants were recruited online. Participants were randomly assigned to view one of three sets of photographs of the back and front of a house: one that had solar panels in front, one that had solar panels in back, and one that did not have solar panels. Then, the participants were asked if they would consider buying the house, how attractive they thought the house was, and how much they thought the house was worth. The placement of solar panels on the house did not affect the perceived attractiveness or the likelihood of participants to consider buying the house, but a house with solar panels was rated as significantly less valuable than a house without solar panels. This study suggests that homeowners considering installing solar panels do not have to be so concerned about how the panels will affect their home's appearance. However, while solar panels will save money on electricity and help the environment, they may also lower the perceived value of a home. People may not object to the appearance of solar panels but also may not appreciate their financial benefit.

Keywords: solar panels, attractiveness, perceptions

## Introduction

Solar panels are a green and sustainable source of energy (Solar explained, 2020). Currently, most household electricity is created by burning fossil fuels, which are in limited supply on Earth. In addition, burning those materials releases greenhouse gases and fuels global warming, slowly raising Earth's temperature (Maslin, 2008). So long as the sun shines on the Earth, solar panels will be able to produce energy. Solar panels also do not fuel global warming because they do not release any harmful greenhouse gases into our atmosphere (Chandler, 2012). Despite all the potential benefits of solar panels, an article by Kennedy and Thigpen (2019) tells us that only 6%

of American homes have solar panels. This small percentage is due, in part, to many people thinking solar panels are unattractive (Dana, 2016). The purpose of this study was to examine how the addition and placement of solar panels affect perceptions of a home.

In addition to being a sustainable and green source of energy, solar panels can be a good financial investment. Solar panels save money on homeowners' electric bills (Truini, 2019). In addition, solar panels increase the value of a house. According to Shaina Mishkin (2019), a Zillow analysis compared similar homes with and without solar panels and discovered that "On average, solar panels raise a home's value by 4.1% across the U.S." This value may differ based on where you

live. The addition of solar panels to homes in the metropolitan areas of New York City, NY and Orlando, FL resulted in the greatest boost to a home's value at 5.4 and 4.6%, respectively (Mishkin, 2019).

Despite all of the benefits associated with using solar panels, many believe that solar panels are unattractive. A set of rules in Vermont prohibits many large solar projects because people think they interfere with the “aesthetics” and “scenic beauty” of the area (Dana, 2016). Many people are concerned that by buying solar panels they will diminish their home’s “curb appeal” (how attractive the house looks from the curb) (Dana, 2016). A recent study found that certain features on solar panels are much preferred over others. This survey showed that people liked black frames and panels the most and liked solar panels with round cells more than other shapes such as squares (Bao, Ferik, Honda, & Shaukat, 2017).

The way that solar panels look is, in fact, very important when analyzing how much a house is worth. A study described in *The Wall Street Journal* found that homes with “excellent curb appeal” (e.g., having well maintained lawns and/or attractive landscaping) were bought for 7% more than similar houses located in the same area (Bonislowski, 2020). An additional study showed that houses that appeared to have a good atmosphere and architecture sold for higher prices than houses that did not have a good atmosphere and architecture (Freybote, Simon, & Beitelspacher, 2016).

Changing the direction solar panels face can have an effect on how much energy is produced. For homes in the Northern Hemisphere, most people say that you should always face your solar panels to the south which, unfortunately for some people, is their street-facing side. West-facing solar panels, however, can be even better because they produce the most energy during the late afternoon and evening when people are using the most energy (Cost of Solar, 2013). Another source argued that for homes above the equator

solar panels can face any direction but north (Clendaniel, 2011). Moving solar panels to a spot invisible to people on the street may improve curb appeal, and curb appeal is believed to raise property value (Bonislowski, 2020).

While people have attributed the low number of American homes with solar panels to people’s concerns with the panels’ appearance, no studies were found that actually tested the effect of solar panels on perceptions of houses. Another gap in the existing research on solar panels is the lack of knowledge about how the placement of solar panels (front v. back) affects curb appeal. This study sought to address these unanswered questions. It was hypothesized that 1) Compared to people who see a house without solar panels, people who see a house with solar panels will rate the house A) more valuable but B) less attractive, and they will rate themselves C) less likely to consider buying the house. 2) Compared to people who see a house with solar panels in the front, people who see a house with solar panels in the back will rate the house A) of similar value but B) more attractive, and they will rate themselves C) more likely to consider buying the house.

## Method

### *Participants*

Participants were recruited through Amazon’s Mechanical Turk to access a diverse population. Participants were invited to be in a study “to look at people's views of houses based on their external appearance.” People who were interested clicked on a link to a survey created on Qualtrics. The first page of the survey was a consent form; participants who agreed to take part in the study were then randomly assigned to see one of three photos of a house: A house with solar panels in the front, a house with solar panels in the back, and a house without any solar panels. Participants ranged from 19 to 74 years of age with a median age of 36. Over half (56.7%) of the participants were male, and 43.3% of the participants were female. Around three-quarters

(77.8%) of participants self-identified as White, 7.8% of participants self-identified as Asian or Asian American, 5.6% of the participants self-identified as Black or African American, 5.6% of participants self-identified as Native American, 1.1% of the participants self-identified as Hispanic or Latino, 1.1% of participants self-identified as multiracial, and 1.1% of participants identified as “other.” Participants came from 27 different states with 40% of participants coming from California, New York, and Texas. Among the participants, 73.3% had owned a home in the past and 24.4% of participants had not owned a home in the past.

### Materials

The first step in creating the experimental stimulus was to find a house that could be manipulated so that it would appear to have solar panels on its front and back. A photograph was taken of a house with a roof that was visible from about 100 yards away from ground level on both sides of the home. An online photograph of a blue, square solar panel with silver edges so that it would not match the generic solar panel (Marsh, 2017) was found. Then, an app called Superimpose was used to edit the solar panel picture onto the house to create three versions of the house. One version had no solar panels, another version had solar panels on the back, and one last version had solar panels on the front; the images can be found in Figure 1. The participants were randomly assigned to see one of the three pictures.

After viewing the photo of the house, the participants were given a survey. The survey included an attractiveness scale with 8 items on a 6-point Likert-type scale that asked about various aspects of the house’s appearance found in a previous study (Freybote et al., 2016). To measure perceptions of value, participants reported how much they thought the house was worth in USD. Participants were also asked whether or not they would consider buying the house, also using a 6-point Likert-type scale. At the end of the survey, participants were asked to complete several

demographic questions and a manipulation check to make sure that participants were aware of the presence and placement of the solar panels.



Figure 1. House Images

The hypothesis dictating that houses with solar panels would be rated as more valuable was not supported. As shown in Figure 2, the opposite result occurred. The perceived value of a house with solar panels was significantly less than the perceived value of either house without solar panels  $F(2, 58) = 3.44, p < .05$ .

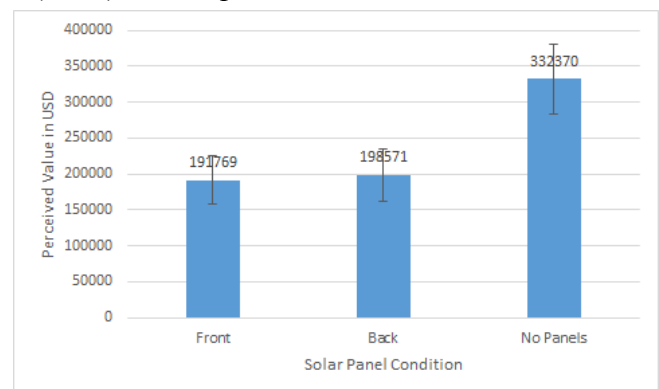
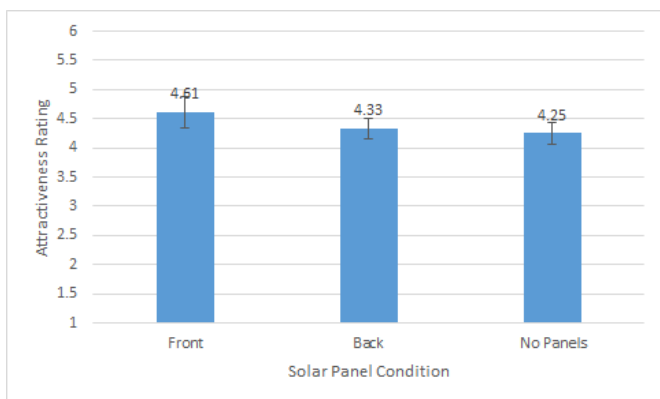


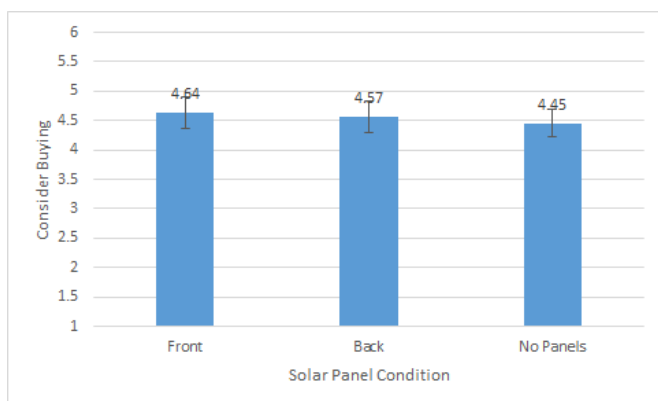
Figure 2. The Effect of Solar Panels on the Perceived Value of a House in USD

Contrary to the hypothesis that solar panels on the front of a house would reduce perceptions of the house's attractiveness, the ratings in all three conditions were statistically equivalent,  $F(2, 87) = 0.74, p=.48$ . The means and standard error of each condition are shown in Figure 3.



**Figure 3. The Effect of Solar Panel Placement on Perceptions of House Attractiveness**

Neither the presence nor placement of the solar panels affected whether or not people would consider buying the house,  $F(2, 87) = 0.14, p=.87$ . Figure 4 displays the means of each condition.



**Figure 4. The Effect of Solar Panels on Whether or not People Would Consider Buying a House**

## Discussion

Houses with solar panels were not rated less attractive than the control house. In fact, the house with solar panels in the front actually received the highest attractiveness ratings,

although the difference was insignificant. This unexpected finding may be caused by the particular questions on the attractiveness scale. For example, one item asked if the house was unique while another asked if it had any “interesting architectural features.” A solar panel may not be pretty, but it may make a house appear more interesting (Why Solar Panels Can Actually Look Great, 2017). Another possibility may be that, when asked what they think about solar panels' attractiveness, people report that they are unappealing, but, when shown a picture of a house with solar panels, their perceptions are not actually affected. Past research has shown that people say they especially dislike solar panels that are colorful or have oddly shaped cells (Bao et al., 2017). It should be noted that the solar panels used in this study were dark blue and had square cells, which might not have matched people's negative image of solar panels.

D-19 caused a dramatic shift in the school experience for both students and teachers. Students were forced to change the way in which they learned. The new and rapid changes impacted the responsibilities of students. Not only is it important to recognize what students went through during the pandemic, but teachers need to know how to approach a similar situation in the future. On top of that, the administration can take note for future school policies which would incorporate positives and negatives to support the students. The research question this study aims to answer is: How does online, hybrid, and face-to-face learning affect high school students' academic motivation level during the 2020-2021 school year compared to prior years? This study seeks to look into two different hypotheses.

Contrary to the hypothesis that solar panels would increase the value of a home, houses without solar panels were rated more valuable than houses that had solar panels, regardless of the direction they faced. It had been thought that solar panels would be seen as a bonus that could save one a lot of money (Truini, 2019). Even though

people in this study did not rate houses with solar panels as less attractive, they may have thought that other people would not like the solar panels, which would drag down the home's resale value. Many people who sell solar panels fear that homeowners believe solar panels are both aesthetically displeasing and will appear out of place on their homes (Why Solar Panels Can Actually Look Great, 2017). The finding that the presence and placement of solar panels did not affect the perceived attractiveness of the house suggests that while widespread, this belief may be false. Nonetheless, if people think that others find solar panels unattractive, they may be led to think that a house with solar panels is less valuable.

It was hypothesized that solar panels would make someone less likely to consider buying a house, but, in fact, the results suggest that people did not care whether or not a house had solar panels. The house shown to participants is a fairly typical-looking house. It is in good condition and has a yard. Solar panels may not make such a huge difference that they would prevent people from even considering the house. Just because people thought the house with solar panels was worth less, did not mean they would not consider buying it.

It is important to note that this study was done on one specific house with one type and color of solar panel. To determine the effect of a variety of different panels on a variety of different types of houses more experimentation would need to be done. It also would be interesting to test how the results might differ between people in different parts of the country; people in places that are sunnier may have more positive perceptions of solar panels. Given that the present study showed that people thought solar panels decreased the value of a house, it would be worthwhile to explore whether highlighting the monetary benefits of solar panels could change this negative view.

While solar panels may lower the perceived value of a home, they do not seem to have an effect on the attractiveness of a house or how likely one is to consider buying that house. People who are looking to invest in solar panels

should not be afraid of how the house will look. Not only will the panels save money on electricity, they will help to save the environment as a clean source of energy.

## References

- Bao, Q, Ferik, S.E, Honda, T & Shaukat, M. (2017). Understanding the role of visual appeal in consumer preference for residential solar panels. *Renewable Energy*, 113. <https://doi.org/10.1016/j.renene.2017.07.021>
- Bonislowski, A. (2020). Selling your home? It's what's on the outside that counts. *The Wall Street Journal*. <https://www.wsj.com/articles/selling-your-home-its-whats-on-the-outside-that-counts-11579792560>
- Best direction to face solar panels - south or west? (2013). *Cost of Solar*. <https://www.costofsolar.com/best-direction-to-face-solar-panels-south-or-west/>
- Chandler, N. (2012). How does solar power help the environment? *How Stuff Works*. <https://science.howstuffworks.com/environmental/energy/solar-power-help-environment.htm>
- Clendaniel, M. (2011). Where can you put solar panels? Almost anywhere you want. *Fast Company*. <https://www.fastcompany.com/1779540/where-can-you-put-solar-panels-almost-anywhere-you-want>
- Dana, R. (2016). The aesthetics of solar: Why looks matter. *Solar Tribune* <https://solartribune.com/the-aesthetics-of-solar-why-looks-matter>
- Denchak, M. (2018). Fossil fuels: The dirty facts. *NRDC* <https://www.nrdc.org/stories/fossil-fuels-dirty-facts>
- Freybote, J., Simon, L., & Beitelspacher. (2016). Understanding the contribution of curb appeal to retail real estate values. *Journal of Property Research* 33(2), 147-161, DOI: 10.1080/09599916.2015.1135978
- Kennedy, B., & Thigpen, C. L. (2019) More U.S. homeowners say they are considering home solar panels. *Pew Research Center* <https://www.pewresearch.org/fact-tank/2019/12/17/more-u-s-homeowners-say-they-are-considering-home-solar-panels/>
- Marsh, J. (2017). Why are solar panels blue? *Energy Sage* <https://news.energysage.com/why-are-solar-panels-blue/#:~:text=Most%20solar%20panels%20have%20a,are%20made%20with%20monocrystalline%20silicon.>
- Maslin, M. (2008). *Global Warming: A Very Short Introduction*. *books.google.com*. [https://books.google.com/books?hl=en&lr=&id=7waExgo5OP8C&oi=fnd&pg=PT17&q=related:sIqS7IlhzewJ:scholar.google.com/&ots=rlmj-h\\_t4R&sig=IEfceNSxWOVkffp\\_oaCzHzWRATE#v=onepage&q&f=false](https://books.google.com/books?hl=en&lr=&id=7waExgo5OP8C&oi=fnd&pg=PT17&q=related:sIqS7IlhzewJ:scholar.google.com/&ots=rlmj-h_t4R&sig=IEfceNSxWOVkffp_oaCzHzWRATE#v=onepage&q&f=false)

- Mishkin, S. (2019). Here's how much adding solar panels will boost your home's value. Money.com. <https://money.com/home-value-solar-panels/>
- Solar explained. (2020). U.S. Energy Information Administration. <https://www.eia.gov/energyexplained/solar/solar-energy-and-the-environment.php>  
Retrieved on: September 23, 2020.
- Truini, J. (2019). Is going solar right for you? Popular Mechanics. <https://www.popularmechanics.com/home/outdoor-projects/a28523667/solar-panels-energy/>
- Why solar panels can actually look great. (2017). Prospect Solar <https://www.prospect solar.com/solar-panels-can-actually-look-great>



# The Impact of COVID-19 on Students' Academic Motivation

Tracy Gold, Jericho High School

tracy.gold@jerichoapps.org

## Abstract

COVID-19 has greatly impacted the way schools function on a daily basis. This study aims to determine how high school students' academic motivation was affected by COVID-19 and the various models of learning: hybrid, online, and face-to-face. In terms of this study, the model of learning was defined as the educational setting where the student is participating in school for this academic year. The first hypothesis states that all students are less motivated during COVID-19 than they were before COVID-19. The second hypothesis states that students who participate in a face-to-face learning model are more motivated than students who participate in hybrid learning and online learning. To test the hypotheses, an online survey was distributed to high school students in a suburban area. Respondents were divided into three groups based upon the model of learning they participate in and were asked to respond to a series of questions about their motivation both during and prior to COVID-19. The results showed that students were more academically motivated before COVID-19 compared to during COVID-19 and that the model of learning affected student's academic motivation in-class. Moreover, students amongst all three learning models struggled more to find motivation during COVID-19 than before COVID-19. Additionally, students' academic motivation did not vary between the three models of learning during COVID-19. Therefore, future research should look into permanently implementing an online model of learning into schools.

Keywords: academic motivation, online learning, COVID-19

---

## Introduction

COVID-19 caused a dramatic shift in the school experience for both students and teachers. Students were forced to change the way in which they learned. The new and rapid changes impacted the responsibilities of students. Not only is it important to recognize what students went through during the pandemic, but teachers need to know how to approach a similar situation in the future. On top of that, the administration can take note for future school policies which would incorporate positives and negatives to support the students. The research question this study aims to answer is: How does online, hybrid, and face-to-face learning affect high school students' academic motivation level during the 2020-2021 school year compared

to prior years? This study seeks to look into two different hypotheses.

Prior to COVID-19, a majority of high school students attended school face-to-face five days a week ("Facts: Is Online"). In addition to that, students typically spent 35 hours a week learning for about 180 days of the year (Christakis, 2020). While the amount of time students spent attending school was still the same as previous years, COVID-19 greatly impacted how schools functioned on a daily basis. First of all, it was less common for all students to attend school face-to-face every day. A vast majority of schools offered students three different ways to participate in school: hybrid, online, and face-to-face. According to Garrison and Kanukais (as cited in Hrastinski, 2019), hybrid learning is defined as "the

thoughtful integration of classroom face-to-face learning experiences with online learning experiences” and was a relatively new concept that many high schools began to offer since the outbreak of COVID-19. Online learning was another option which allowed students to continue learning daily, but from the comfort of their own home. The final option was face-to-face which enabled students to attend school as they did prior to the pandemic. The combination of these three options allowed students to learn safely during COVID-19.

During the pandemic, public safety guidelines specified that students and teachers could not stand within six feet of each other, therefore limiting the number of students allowed in one classroom (Centers for Disease Control and Prevention, 2021). According to Brookshire (2020), it was difficult for some students to identify how far six feet is. As a solution for crowded cafeterias and hallways, schools placed dots on the floor to indicate where to stand. Goldstein (2020) stated that upon arrival at school, students' temperature was likely to be taken as this could have helped to prevent the spread of the coronavirus. Furthermore, some students could be online learning while in class under unique circumstances (Goldstein, 2020). The pandemic put students in a new and unexpected situation, making it a difficult transition for them. However, with various models of learning and rules set forward, teachers continued to safely educate students.

### *Classroom Engagement*

The dramatic shift from solely face-to-face learning to hybrid and online learning may have impacted students' motivation in the classroom as well as teachers' ability to keep their students motivated throughout the class period. In order for students to be academically successful, engagement in the classroom was important (Cooper, 2014). For students to be continuously engaged during class, teachers must be aware of

what they should be incorporating into class lessons. Research by Howard (2016) found that to increase classroom engagement and motivation, a choice board option, with the inclusion of technology, was suggested. Another recommendation was for students to flaunt their knowledge through various projects, such as writing stories (Howard, 2016). Developing upon this idea, having projects with numerous aspects allowed students to connect personally, keeping them motivated to be successful (Beffa-Negrini et al., 2002). As studies have shown, keeping students motivated was critical for success; however, the change in learning environment for students during COVID-19 may have affected their level of academic motivation and has yet to be studied.

Student and teacher relationships are important factors in a successful classroom. Studies found that students who trust their teachers and actively participate in class activities allow for a highly functional classroom (Gregory & Ripski, 2019). During COVID-19, with students participating in one of the three models of learning, it was difficult for teachers to run class smoothly and effectively.

### *Student Success*

The success of students within class was found to be dependent on several factors. It was important to note that students who set achievable academic goals, especially those who are struggling, were more likely to feel an incentive to complete their work. More often than not, those same students eventually make noticeable progress in the class (Margolis & McCabe, 2003). Harmonious with previous studies conducted prior to the pandemic, improving study habits, through a utilized study plan and hard work, was crucial to improving academic performance (Sharma, 2017). On top of that, teachers should be supporting their online students both technically and technologically as it will help to fulfill the students' expectations of their course (Sahin &

Shelley, 2008). The availability of technology and online resources allow teachers to continue teaching students successfully, despite the circumstances (Mukhopadhyay et al., 2020). However, encouraging internet use for reasons other than to learn and to collaborate with others negatively impacted students' motivation as they were more likely to use the internet for help with their course assignments (Reed & Reay, 2015). Literature investigating education prior to the pandemic indicated that technology has been integrated into classrooms, but the increased dependence on the internet is a potential for distractions to students and has yet to be studied under these new learning circumstances.

With COVID-19 requiring a rapid change in learning environments for students, previous literature isn't sufficient enough in understanding students' success as many changes have been made to how a school day works. Thus, research is needed to analyze how students' motivation in various categories, such as homework, in-class, and testing, may have changed during COVID-19 in various models of learning.

#### *Student Satisfaction and Grades in Different Learning Environments*

Research analyzed the difference in students' satisfaction in an online learning course and a face-to-face learning course. While online learning was a concept for many years that continuously improves as time goes on and technology advances, it was determined that students participating in an online course were less satisfied than those who were in a face-to-face course (Tratnik et. al, 2019). Although students in both an online learning course and a face-to-face learning course appeared to perform similarly on exams, it was likely that those online had suffered as they were not as pleased with the course (Lyke & Frank, 2012).

#### *Academic Integrity*

Honesty in the classroom is the base for students' success, and it can be difficult to monitor students' honesty in an online model of learning. Research conducted by Tsai (2016) found that there was always some academic misconduct among undergraduate students despite the testing environment. Not only should teachers and administration be educating students on the significance of honesty during exams with no supervision, but schools should also be enforcing prevention policies (Tsai, 2016). Stress was thought to be a potential factor in students' cheating behaviors. Oftentimes, when students are under pressure during timed exams they make poor choices, leading them to use outside sources for answers (Eaton, 2020). Communication between teachers and students, especially in online classes, was essential to help reduce students' stress and anxiety (Beffa-Negrini et al., 2002). Furthermore, it was especially difficult to test students' understanding of a subject when the exam was proctored online (Tsai, 2016). In spite of that, studies have shown there was less academic misconduct among online students compared to those who are face-to-face. However, those same studies have concluded that students in online courses tend to be older and have chosen to voluntarily take the course (Eaton, 2020).

Surprisingly, while Eaton's research suggests that face-to-face students were more likely to cheat on their exam than online students, it has been found that online students appear to have very similar grades to those who are face-to-face (Lyke & Frank, 2012). It has yet to be known if online and face-to-face students are equally motivated, which could explain why students in both learning models share similar grades (Edmonds, 2006).

#### *Hypotheses*

This study aims to answer the following hypotheses: The first hypothesis states that

compared to prior to COVID-19, students during COVID-19 are less motivated. Motivation will be measured through students' homework, class participation, and testing. The second hypothesis states that compared to students who participate in hybrid learning and online learning, participants exposed to face-to-face learning will be more motivated. In terms of this study, the model of learning is defined as the educational setting where the student is participating in school for this academic year.

## Method

### *Participants*

Adolescents currently in high school were the suggested population of the present study based upon the research question and hypotheses. High school students were chosen as the participants because they had been greatly impacted by COVID-19 and the introduction of new educational learning models. There is a lack of research examining high school students' motivation based on the model of learning they participate in. This is due to the fact that two of the models analyzed in this study, hybrid learning and online learning, were relatively new concepts across the high schools in the target group. Therefore, this study seeks to fill that gap.

Most high school students examined in this study attended High School X, an anonymous high school located in a suburban area on the east coast. In High School X, the survey was distributed to the Student Body Government as well as history teachers who then distributed it to their students. The survey was also disseminated to different high schools through a collection of a snowball sample. Snowball sampling is a technique where I posted the survey to social media and individuals reposted the survey in order to reach a larger population. It is beneficial for this study to examine data from various high schools as some students may be more competitive than others, thus aiming for high grades despite the learning circumstances.

There is a paragraph explaining the purpose of the survey for participants to read before taking part in the survey. Passive consent was included in this introduction, informing the participants that all data is protected and they may stop taking the survey at any time. In order to distribute the survey, approval was required from High School X's Institutional Review Board (IRB).

### *Independent Variables*

This survey contained three sections pertaining to the variables studied: model of learning and motivation. The independent variable in this study is the type of learning environment: online, hybrid, or face-to-face. Section one (questions 1-6) was related to the model of learning variable. This section was located at the start of the survey and required all participants to answer how they attended school for the 2020-21 school year in order to be directed to the correct series of questions. The questions related to the model of learning variable were included in the survey to provide a deeper context of how hybrid learning functions in the respondents' school. This was essential as not all respondents attended High School X, therefore, not all respondents who participated in a hybrid model of learning followed the same weekly schedule.

### *Dependent Variables*

The dependent variable in this study is academic motivation. In order to measure the variable of motivation in sections two and three (questions 7-48), each question was asked two times. All questions pertaining to the variable of motivation were asked two times in order to compare participants' academic motivation level prior to the coronavirus outbreak to now. The motivation variable was broken down into five sub-variables: homework, class, school, tests, and further motivation questions. This was done to ensure motivation was measured in various aspects. While all questions were self-developed, they were inspired by previous literature that

determined factors that influence students' motivation. A study done by Park et al. (2019) found that persistent participation in a hybrid course improves students' performance. Therefore, questions related to student participation while in class were asked to all participants. In order to measure homework motivation, participants were asked questions regarding their effort when homework is assigned to them. Class motivation was measured by considering if the participant is engaged throughout class. By asking participants to consider whether they enjoy school, school motivation was measured. Test motivation was measured through preparation for tests. Lastly, further motivation questions were included, focusing on how much time participants spend doing various school related efforts. Most questions collected participants' data using a 5-point Frequency Likert Scale. In the second section, all questions were asked relating to the 2020-21 academic school year, and in the third section all questions were asked relating to school prior to the pandemic.

The last section of the survey consisted of demographic questions (questions 49-52) to gather information about the sample population.

### *Procedure*

After reviewing previous literature, it was concluded that a survey was the most appropriate method to gather data. A survey aligns with this research because it allows for an easy comparison of students in different learning models as well as students' motivation before COVID-19 to during COVID-19. Furthermore, a survey allows for participants to be directed to a certain section based on their response to the model of learning they participate in. A rough draft survey was developed through Google Forms. A pilot survey was then executed on a group of students from High School X to ensure the survey was reliable and there were no grammatical errors. After receiving peer feedback, any necessary changes were made before the survey was distributed

through social media platforms, such as Snapchat and Instagram, and Canvas emails from social studies teachers and the Student Body Government to students at High School X.

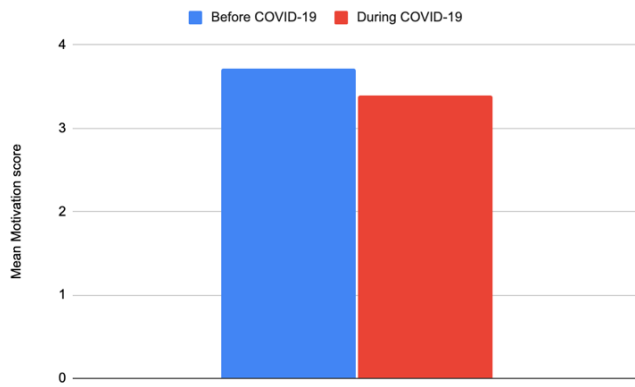
### *Analysis*

After transferring the results into the Statistical Package for Social Science (SPSS), the data collection was analyzed and paired samples t-tests and one-way between-subjects ANOVAs were conducted. A paired samples t-test is used to compare the means of two variables in the same group. In this research, it was used to compare students' academic motivation prior to COVID-19 to during COVID-19. A one-way between subjects ANOVA is used to compare the means of three or more groups. In this research, it was used to compare students' motivation between the three models of learning during COVID-19.

### **Results**

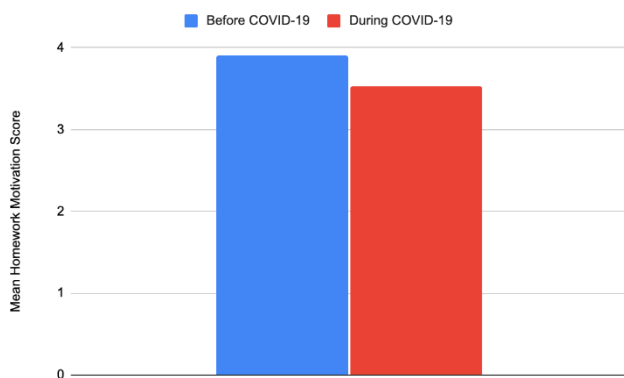
*Hypothesis 1: All students are less academically motivated during COVID-19 than before COVID-19*

A paired samples t-test was conducted to compare the academic motivation of high school students before COVID-19 and during COVID-19. As depicted in Figure 1, there was a significant difference in the scores for the academic motivation before COVID-19 ( $M=3.71, SD=.559$ ) and academic motivation during COVID-19 ( $M=3.38, SD=.049$ ) conditions;  $t(133)=7.272, p<.001$ . The results support the above hypothesis and indicate that high school students were more academically motivated before COVID-19 compared to during COVID-19. This suggests that classroom time was important to overall student motivation.



**Figure 1. Overall Motivation**

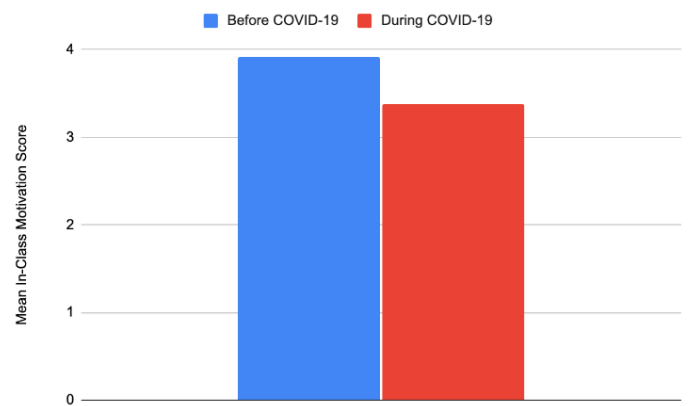
A paired samples t-test was conducted to compare the academic homework motivation of high school students before COVID-19 and during COVID-19. There was a significant difference in the scores for the academic homework motivation before COVID-19 ( $M=3.89$ ,  $SD=.54$ ) and academic homework motivation during COVID-19 ( $M=3.52$ ,  $SD=.60$ ) conditions;  $t(133)=7.550$ ,  $p<.001$ . The results – depicted in Figure 2 – support the above hypothesis and indicate that high school students were more academically homework motivated before COVID-19 compared to during COVID-19. This suggests that classroom time and face-to-face teacher interaction play an important role in students' motivation to complete their homework.



**Figure 2. Homework Motivation**

A paired samples t-test was conducted to compare the academic motivation of students in class before COVID-19 and during COVID-19. As seen in Figure 3, there was a significant difference

in the scores for the academic motivation in-class before COVID-19 ( $M=3.92$ ,  $SD=.70$ ) and academic motivation in-class during COVID-19 ( $M=3.39$ ,  $SD=.73$ ) conditions;  $t(133)=8.761$ ,  $p<.001$ . The results support the above hypothesis and indicate that high school students were more academically motivated in-class before COVID-19 compared to during COVID-19. This suggests that there are more distractions for students who learn online.



**Figure 3. In-Class Motivation**

A paired samples t-test was conducted to compare the academic testing motivation of high school students before COVID-19 and during COVID-19. There was not a significant difference in the scores for the academic testing motivation before COVID-19 ( $M=3.22$ ,  $SD=.80$ ) and academic testing motivation during COVID-19 ( $M=3.22$ ,  $SD=.72$ ) conditions;  $t(133)=-.027$ ,  $p=.98$ . These results cannot reject the null hypothesis and it is possible the insignificance of this result could be due to chance. This suggests that since testing is an individual activity, personal interactions did not impact motivation.

*Hypothesis 2: Students who participate in a face-to-face learning model are more motivated during COVID-19 than students who participate in hybrid learning or online learning*

A one-way between subjects ANOVA was conducted to compare the effect of different models of learning on students' academic

motivation during COVID-19. There was not a significant effect of the model of learning on students' academic motivation at the  $p < .05$  level for the three conditions [ $F(2, 131) = 1.176, p = .31$ ]. These results cannot reject the null hypothesis and it is possible the insignificance of this result could be due to chance.

A one-way between subjects ANOVA was also conducted to compare the effect of different models of learning on students' academic homework motivation during COVID-19. There was not a significant effect of the model of learning on students' academic homework motivation at the  $p < .05$  level for the three conditions [ $F(2, 131) = .375, p = .69$ ]. These results cannot reject the null hypothesis and it is possible the insignificance of this result could be due to chance.

A one-way between subjects ANOVA was conducted to compare the effect of different models of learning on students' academic motivation in-class during COVID-19. There was a significant effect of the model of learning on students' academic motivation in-class at the  $p < .05$  level for the three conditions, as seen in Figure 4 [ $F(2, 131) = 4.854, p = .01$ ]. The results support the above hypothesis and indicate that students' academic motivation in-class varies depending upon the model of learning in which they participate in.

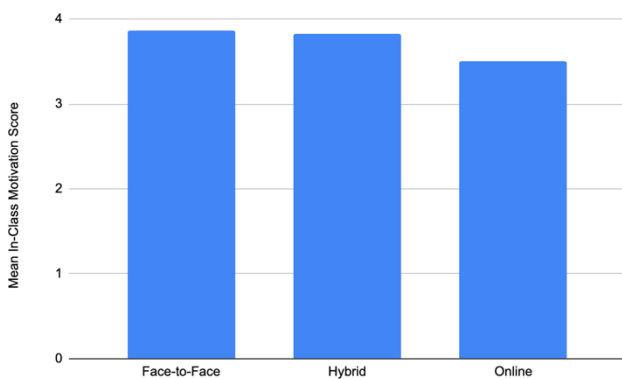


Figure 4. Mean In-Class Motivation Score

While there was a change in students' overall motivation prior to COVID-19 compared

to during COVID-19, there is no significant difference between learning models during COVID-19. This could be due to external stressors during the pandemic and their impact on student motivation.

Due to the significance of the one-way between subjects ANOVA, a post-hoc test was doable. A one-way between groups Analysis of Variance was conducted to compare how high school students' academic motivation in-class was impacted by the model of learning they participate in. Participants were separated into three groups based upon the model of learning they participate in. A Dunnett T3 was conducted since the number of participants in each group varied (10 in face-to-face, 52 in hybrid, and 72 in online). There was a statistically significant difference between hybrid and online students:  $F(2, 131) = 4.85, p = .01$ .

A one-way between subjects ANOVA was conducted to compare the effect of different models of learning on students' academic testing motivation during COVID-19. There was not a significant effect of the model of learning on students' academic testing motivation at the  $p < .05$  level for the three conditions [ $F(2, 131) = .346, p = .71$ ]. These results cannot reject the null hypothesis and it is possible the insignificance could be due to chance.

Overall, when asked how much time spent doing homework and studying during the week and weekend, participants have been spending less time during COVID-19 compared to before COVID-19. These results indicate that students are less motivated in terms of doing homework and studying during COVID-19 compared to before COVID-19.

## Discussion

Four paired samples t-tests were conducted in order to compare the motivation of the same group of students before and during a change in learning. Results suggests that after COVID-19, students' academic motivation declined. This was important for schools to consider when all students

returned to face-to-face learning because high school is a time for students to become self-driven in order to be successful. Moreover, the habits students develop in high school may have lasting effects in their adulthood. Therefore, schools should provide support programs and extra guidance to their students in order for their motivation to return to as it was prior to COVID-19. To further understand this result, student motivation was measured for specific academic categories. It was found that students are less motivated to complete homework during COVID-19 compared to before COVID-19. Moreover, students were less motivated in-class during COVID-19 compared to before COVID-19. Thus, teachers should provide various opportunities for students to find motivation during class (Howard, 2016). Interestingly, results also indicate no noticeable shift in students' academic testing motivation prior to COVID-19 and during COVID-19. However, testing was forced to change due to COVID-19, making it a challenge for teachers to proctor tests and students to take tests. Consequently, this result was surprising because some students' tests were open book, so one would expect the students to be less motivated as they could use the internet for answers. This suggests that students did still care about the grades they earned during the pandemic.

Four one-way between subjects ANOVA tests were conducted to compare three separate groups categorized by their type of schooling and their academic motivation during COVID-19. Results indicate that students' academic motivation during COVID-19 does not vary between the three models of learning. This indicates that teachers have been successful in equally educating all three models of learning. In alignment with this, results indicate that the three different models of learning do not impact students' motivation in regards to testing. This answers the question posed in the study conducted by Edmond (2006) of whether students in online and face-to-face learning models are equally motivated when preparing for tests. As

evidenced by the present study, students who partake in online and face-to-face learning models are equally motivated, as are those in a hybrid model of learning. This could explain why, based upon Edmond's study, students in an online and face-to-face learning model earn similar test grades (Edmond, 2006). In line with these findings, results suggest there is no noticeable effect of the three models of learning on students' academic homework motivation. While students' motivation towards homework is consistent amongst the three learning models, as previously mentioned, it has been found that students are less motivated in regards to homework during COVID-19 versus before COVID-19. Results suggest there is an apparent difference in students' motivation in-class during COVID-19. This is dependent upon which of the three models of learning the students participate in. Due to this significance, an additional test, was conducted to determine which of the learning models are statistically different. It was found that students in a hybrid learning model and online learning model are not equally motivated in-class. Research should look at what aspects of in-class activities directly influence motivation in-class and if those characteristics could be utilized in an online model of learning. Therefore, students' motivation in-class should be investigated further.

### *Limitations*

Several limitations prevent this study from being generalized to a broader audience. Firstly, this research focused on student perspectives in relation to different learning models. This does not provide a complete picture of all members of a school community, and future research should consider teacher and administration perspectives to gain a more well-rounded understanding. Additionally, every high school had developed their own hybrid learning model in response to the outbreak of COVID-19. For instance, some schools required all students to participate in online learning every Wednesday, while other



schools simply had their students alternate every day between face-to-face and online learning based upon their last initial. Thus, different students' motivation could be impacted greater or less due to the way the hybrid model functioned in their school. Moreover, in some schools, students only took their tests on the days they were in school; however, in other schools, students took tests when they were both online and face-to-face. Also, some schools allowed students who participate in a hybrid model of learning to participate in online learning on a day the student should have been face-to-face, while other schools did not give students permission to do this. All of these factors which could have impacted a student's motivation were not controlled for in this study in order to ensure all participants remained anonymous. Furthermore, this study focused on analyzing students' academic motivation, therefore other stresses, such as extracurricular activities, were not controlled for in this study.

Since the participants in this study were predominantly from affluent, suburban areas, they may have easy access to technology. Thus, it cannot be confirmed if the responses from hybrid and online students would be similar or different for participants who struggle with Wi-Fi issues or access to technology. Therefore, these results do not apply to students other than those from affluent, suburban areas.

### *Future Research*

In order to expand on this study, future researchers should further examine testing motivation. Previous literature suggests that academic misconduct may be present when tests are administered online (Tsai, 2016). Therefore, future research should control for academic integrity as this could impact students' motivation.

Future research should also consider looking into permanently implementing an online model of learning for students with certain needs. For example, students with social anxiety or students who cannot attend school physically

could still be at home while also being a part of the classroom. Additionally, there are students who have thrived in an online model of learning and would prefer to continue learning that way.

Research should look at taking what has already been learned from this past academic school year and integrating it into the existing school system.

Research should also be conducted to find out how teachers feel about the various learning models and students' motivation. This study focused on a student's perspective of the three models of learning, but for a successful school, it is essential to note what teachers think as well.

### **References**

- Beffa-Negrini, P. A., Cohen, N. L., & Miller, B. (2002). Strategies to motivate students in online learning environments. *Journal of Nutrition Education & Behavior*, 34(6), 334. [https://doi.org/10.1016/S1499-4046\(06\)60116-4](https://doi.org/10.1016/S1499-4046(06)60116-4)
- Brookshire, B. (2020, September 8). Here's how COVID-19 is changing classes this year. *Science News for Students*. <https://www.sciencenewsforstudents.org/article/coronavirus-covid-19-changing-school-classes>
- Christakis, E. (2020, December). School wasn't so great before COVID, either. *The Atlantic*. <https://www.theatlantic.com/magazine/archive/2020/12/school-wasnt-so-great-before-covid-either/616923/>
- Cooper, K. S. (2014). Eliciting engagement in the high school classroom. *American Educational Research Journal*, 51(2), 363-402. <https://doi.org/10.3102/0002831213507973>
- Eaton, S. E. (2020). Academic integrity during COVID-19: Reflections from the University of Calgary. *International Studies in Educational Administration (Commonwealth Council for Educational Administration & Management (CCEAM))*, 48(1), 80-85.
- Edmonds, C. L. (2006). The inequivalence of an online and classroom based general psychology course. *Journal of Instructional Psychology*, 33(1), 15-19.
- Facts: Is online learning as good as face-to-face learning? (n.d.). University of the People. <https://www.uopeople.edu/blog/online-learning-good-as-face-to-face-learning/>
- Goldstein, D. (2020, July 29). What back to school might look like in the age of COVID-19. *The New York Times*. <https://www.nytimes.com/interactive/2020/07/29/us/schools-reopening-coronavirus.html>
- Gregory, A., & Ripski, M. B. (2008). Adolescent trust in teachers: Implications for behavior in the high school

- classroom. *School Psychology Review*, 37(3), 337-353. <https://doi.org/10.1080/02796015.2008.12087881>
- Howard, C. (2016). Engaging minds in the common core: Integrating standards for student engagement. *Clearing House*, 89(2), 47-53. <https://doi.org/10.1080/00098655.2016.1147411>
- Hrastinski, S. (2019). What do we mean by blended learning? *TechTrends: Linking Research & Practice to Improve Learning*, 63(5), 564-569. <https://doi.org/10.1007/s11528-019-00375-5>
- Lyke, J., & Frank, M. (2012). Comparison of student learning outcomes in online and traditional classroom environments in a psychology course. (Cover story). *Journal of Instructional Psychology*, 39(3/4), 245-250.
- Margolis, H., & McCabe, P. P. (2003). Self-efficacy: A key to improving the motivation of struggling learners. *Preventing School Failure*, 47(4), 162-169. <https://doi.org/10.1080/10459880309603362>
- Mukhopadhyay, S., Booth, A. L., Calkins, S. M., Doxtader, E. E., Fine, S. W., Gardner, J. M., Gonzalez, R. S., Mirza, K. M., & Jiang, X. S. (2020). Leveraging technology for remote learning in the era of COVID-19 and social distancing: Tips and resources for pathology educators and trainees. *Archives of Pathology & Laboratory Medicine*, 144(9) 1027-1036. <https://doi.org/10.5858/arpa.2020-0201-ED>
- Operational strategy for K-12 schools through phased prevention. (2021, May 15). CDC. <https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/operation-strategy.html>
- Park, E., Martin, F., & Lambert, R. (2019). Examining predictive factors for student success in a hybrid learning course. *Quarterly Review of Distance Education*, 20(2), 11-27.
- Reed, P., & Reay, E. (2015). Relationship between levels of problematic internet usage and motivation to study in university students. *Higher Education (00181560)*, 70(4), 711-723. <https://doi.org/10.1007/s10734-015-9862-1>
- Sahin, I., & Shelley, M. (2008). Considering students' perceptions: The distance education student satisfaction model. *Journal of Educational Technology & Society*, 11(3), 216-223.
- Sharma, G. (2017). Study habit of high and low achiever. *Indian Journal of Positive Psychology*, 8(2), 158-161.
- Tratnik, A., Urh, M., & Jereb, E. (2019). Student satisfaction with an online and a face-to-face business English course in a higher education context. *Innovations in Education & Teaching International*, 56(1), 36-45. <https://doi.org/10.1080/14703297.2017.1374875>
- Tsai, N. W. (2016). Assessment of students' learning behavior and academic misconduct in a student-pulled online learning and student-governed testing environment: A case study. *Journal of Education for Business*, 91(7), 387-392. <https://doi.org/10.1080/08832323.2016.1238808>

# The Effect of Genetically Modified Labeling of Plant and Animal Products on Consumer Perceptions

Emily Yeh, Roslyn High School

eyeh22@roslynschools.org

## Abstract

Genetically modified organisms help provide food for the growing world population, however, research has shown that many people fear GMO technology, despite scientists agreeing that it is safe (Public opinion about genetically modified foods, 2016). The present study examined the effect of label and product type on participants' willingness to consume a product and their perceived risk of doing so. Participants (N=159) were randomly assigned to view an advertisement for a product (rice or chicken), and this product either had no label, a non-GMO label, or a GMO label. Data analysis revealed that people perceived the non-GMO labeled products to be less risky than the GMO labeled products. Additionally, women reported the greatest willingness to consume products with non-GMO labels, while men reported the greatest willingness to consume GMO labeled products. This difference suggests that attitudes about GMOs differ based on the type of label and gender and suggests that there is still work to be done in order to improve GMO perceptions.

Keywords: GMO, GMO labels, GMO products, Non-GMOs, Non-GMO labels

## Introduction

In recent years, GMOs (genetically modified organisms) have gained a large amount of attention, as shown by the number of searches more than tripling for the term GMO between 2012 and 2015 (Rangel, 2015). A GMO is defined as any organism or microorganism whose genes have been altered in a laboratory through genetic engineering or transgenic technology. This process leads to gene combinations that do not occur in nature (What is a GMO, n.d.). GMOs have increased the supply and reduced the costs of food for many, and scientists agree that GMO foods are safe (Genetically engineered foods, 2018). Nonetheless, people tend to have negative attitudes towards GMOs and their safety (Public opinion about genetically modified foods, 2016), something that is commonly seen in reactions to

many new technologies involving genetics and organisms such as vaccines. As an issue that threatens to alter our food security, these negative attitudes must be addressed and resolved. This study looked at the effect of the type of GMO (plant or animal) and type of labels (no label, non-GMO label, and GMO label) on participants' willingness to consume a product and people's perceived risk towards GMOs.

Over the years, research has revealed that there are mixed feelings regarding the topic of GMOs. One study conducted in Chengdu, China in 2011 showed that 34% of respondents supported GMOs, 24.3% opposed them, and 41.7% were neutral (Cui & Shoemaker, 2018). These differing attitudes are due to the perceptions of both risks and benefits related to GMOs. Some of the benefits include an increase in agricultural productivity and a reduced need for pesticides;

however, some people believe that GMOs may also pose health risks and increase rates of allergies (Qaim, 2010). Another benefit to GMO food could be added nutrients such as vitamin B and a higher shelf life as well as possible medicinal qualities added in (Genetically engineered foods, 2018).

Research has shown more positive opinions have been found toward using GMOs to create medicine as opposed to food. In a UK study that surveyed over 16,000 people, the average rating of the morality of using GM for medicine was over 3.0 on a scale of 1.0-4.0, which is higher compared to food which was closer to the midpoint of 2.5 on the same scale (Europe ambivalent on biotechnology, 1997). Another study showed that out of 964 respondents, the highest percentages of acceptance for the usage of GMOs were for medicinal (62%) and health (68%) purposes (Widmar et al., 2017). Likewise, in a Malaysian study of 550 respondents, GM insulin was perceived to be more beneficial and more supported than GM soybean (Amin, Jahi, & Nor, 2013).

Research suggests that GMO labeling can have various effects on how willing someone is to consume that product. Most commonly, people tend to prefer a non-GMO labeled product or one with no label over a GMO labeled product. For example, in the United States, an experiment saw that participants were 12.2% more likely to say they would purchase produce (strawberries, apples, and potatoes) without a GMO label after being shown a labeled version (Yeh, Gomez, & Kaiser, 2019). The researchers found that 50% of participants were more willing to buy a product with no label as opposed to a GMO label (Bansal, Chakravarty, & Ramaswami, 2013). This study reasoned that the greater aversion to foods with a GMO label could be caused by a thought process where consumers believe it to be riskier, due to the need to label it (Bansal et al., 2013). Another study that looks at GMO perception in college students have also compared a non-GMO label to a GMO

label; however, they found that there was no significant difference between the perceptions of those that received either condition (Oselinsky, Johnson, Lundeborg, Holm, Mueller, & Graham, 2021).

People's attitudes towards GMOs may also depend on the type of organism being modified. For example, a study in Australia showed that participants were more comfortable with GMO foods derived from plants than ones from animals (Marques, Critchley, & Walshe, 2015). Due to how animals are closer to humans than plants are, this result suggests that as technology advances, one may feel like modifying humans would be more likely than before, this is something that many may fear (Simmons, D., 2008). In addition, although the comfort level with plants was higher, comfort levels were still relatively low with numbers around 3 and 4 on a 10-point scale. This further points to how consumers are hesitant towards GMO foods overall.

Although previous studies have observed the effect of no label and a GMO label on consumer willingness to buy, the present study adds a non-GMO label condition. Previous studies have assumed that the no label condition would be seen as a non-GMO product by consumers; however, this study looks at whether consumers' perception of a non-GMO label differs from their perception of no label. Additionally, while many previous studies report perceptions of GMO products based on surveys, this study used an experimental design to hopefully show more realistic results. Asked how safe GMO bananas are, people may assume they are being asked because the bananas are unsafe. Shown an advertisement for a banana that may indicate it is GMO or not may elicit a response more similar to how people would react when buying groceries. This experiment explored the effect of the type of GMO (plant or animal) and types of labels (no label, non-GMO label, and GMO label) on the willingness to consume and perceived risk.

In order to determine the effect of these factors, the following hypotheses were tested: 1) Compared to a genetically modified animal product, a genetically modified plant product will a) have a higher intention to be consumed and b) will be seen as less risky; 2) Compared to products with a GMO label, products with a non-GMO label will a) have a higher intention to be consumed, b) will be seen as less risky.

## Method

### *Design*

The design of this study was a 2 ( rice vs. chicken ) x 3 ( no label vs. non-GMO label vs. GMO label ) between-participants design. Rice and chicken were chosen because they are commonly consumed foods in the United States (Shahbandeh, 2021a; Shahbandeh, 2021b). Participants were presented with a consent form and then viewed an advertisement for a product. Participants were randomly assigned to view one of six advertisements: a GMO labeled chicken, a GMO labeled rice, a non-GMO labeled chicken, a non-GMO labeled rice, a chicken with no label, and rice with no label.

### *Procedure*

Participants then completed a survey that evaluated their willingness to consume the product and their perceived risks of GMOs concerning the product shown. Before completing the survey, participants also answered a manipulation check to confirm that they saw the label type and product. Finally, they reported their demographics which included items such as their age and ethnicity.

### *Participants*

Participants were recruited through Amazon Mechanical Turk, an online system where people perform tasks for a small amount of money. Samples of participants that are acquired from Mechanical Turk have been shown to be closely

representative of the U.S. population (Moss & Litman, 2021). All participants in this study were adults living in the United States. In this study, 69.6% of participants identified as White, 11.8% as Asian, 8.7% as Black, 5.6% as Hispanic/Latinx, 1.2% as American Indian or Alaska Native, and 3.1% identified as “other”. The mean age of the participants was 37.2 and the range was 56 with the youngest participant being 18 and the oldest being 74. Of these participants, 85 were male making up 53.8% of the sample and 73 were female making up 46.2% of the sample.

### *Experimental Stimuli*

Six versions of advertisements for a product were created for this study (see appendix). These advertisements could either feature rice or chicken products. To manipulate the product to have different label types, a sticker was created based on actual existing GMO labels and modified to say GMO or non-GMO was placed on the product, and on some of the conditions, no label was added. In addition, a sentence was added to the nutrition facts if it was a GMO that read “Produced with genetic engineering”. This can be seen in the appendix under the experimental stimuli.

### *Dependent Measures*

For this experiment, there were two dependent variables measured with a survey. To measure the willingness to consume variable, two items were used that stated “I would consume this product” and “I would buy this product”. Additionally, for the perceived risks variable there were five items taken from previous studies (Kikulwe, Wesseler, & Falck-Zepeda, 2011; Zhang, Jing, Bai, Shao, Feng, Yin, & Zhang, 2018); all items can be seen in the appendix. All the items were measured with a 6 point Likert scale and there was also an option where the participants could choose not to answer. The scales were all reliable with a Cronbach’s alpha coefficient of .89 for the willingness to consume

scale and a coefficient of .78 for the perceived risk scale.

### Data Analysis

An analysis of variance (ANOVAs) was conducted to quantify the effect of GMO labels and type of the organism (plant or animal) on participants' willingness to consume and their perceived risks of GMOs. The analyses showed that men and women responded differently to the stimulus so gender was included as a third independent variable. Tukey post hoc tests were then used to determine the differences between pairs of groups. To test the second hypothesis two independent t-tests were also run to compare the non-GMO labeled conditions to the GMO labeled conditions.

## Results

### Data Analysis

GMO labels had a significant effect on perceived risk,  $F(2, 159)=3.76, p<.05, \eta_p^2=.05$ . As hypothesized, the post hoc tests showed participants perceived the GMO labeled conditions to be riskier than the non-GMO labeled conditions; however, the no label condition did not differ significantly from either the non-GMO or the GMO label.

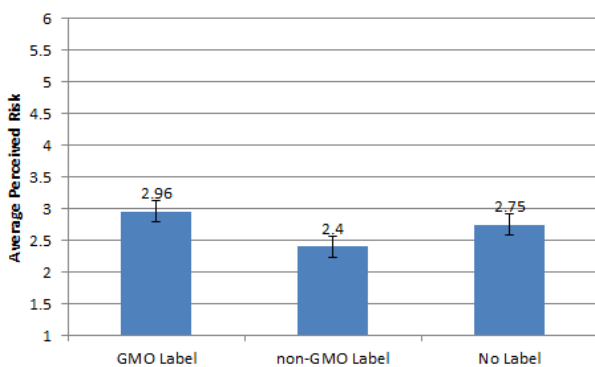


Figure 1. The Effect of Labels on Perceived Risk

### Labels and Willingness to Consume

The hypothesis that GMO labeling would have an effect on the willingness to consume was not supported,  $F(2, 157)=0.07, p=.94, \eta_p^2=.001$ .

However, the ANOVA revealed that gender and label type had a significant interaction that affected the willingness to consume a product,  $F(2, 154)=4.51, p<.05, \eta_p^2=.06$ . As shown in Figure 2, female participants reported that they were more likely to consume a product that had no label or a non-GMO label, while male participants reported that they were most likely to consume a product with a GMO label.

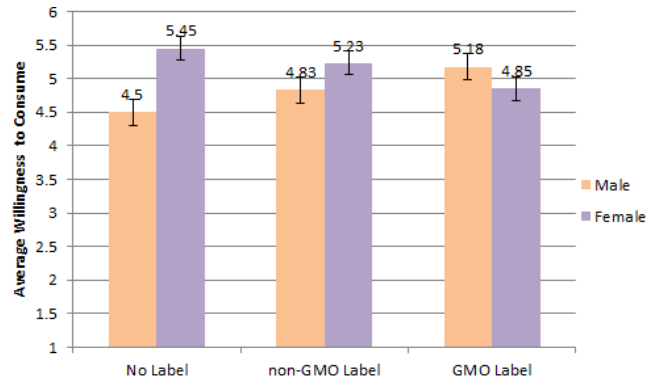


Figure 2. The Effect of Gender and Label Type on Willingness to Consume

## Discussion

### Perception of Risk

The data supported the hypothesis that people will view products with GMO labels as riskier compared to products with non-GMO labels. This result is understandable when looking at how consumers perceive new technologies. One example could be seen recently where people are refusing the COVID-19 vaccines because of the new mRNA vaccine technologies that they implement. The Lancet, reports that many people tend to avoid new information that challenges their beliefs (Adhikari & Cheah, 2021). To combat the issue of hesitancy and prolonged refusal of beneficial technologies, one has first to identify the reason behind the negative reactions. For humans who fear the uncertain (Rietzler, 1944), being hesitant is not uncommon; however, when it begins to affect the progress that could be made, steps should be taken to educate and help the

public in understanding these technologies especially for GMO foods.

### *Willingness to Consume*

On the other hand, the hypothesis that participants would be more willing to consume the non-GMO labeled products as opposed to the GMO products was not supported. However, the results showed that women are more willing to consume an unlabeled product and a non-GMO labeled product than a GMO-labeled product. On the other hand, men reported they were more willing to consume a GMO-labeled product and less willing to consume a product that had a non-GMO label or was not labeled. The pattern shown by the female participants matches the findings of previous studies (e.g., Cui & Shoemaker, 2018), and raises the question of why men reacted differently. It may be that men simply pay less attention to labels than women or less attention to whether or not a product is modified. Another possibility is that men are not as concerned about GMOs and do not see them as a serious threat. In addition, women tend to do more of the grocery shopping for their families with a survey revealing that 80% of women do the shopping compared to 20% of men (Among U.S. couples, women do more, 2019), and may feel more responsible for providing healthy products. Men may also be less sensitive to risk (Melore, 2021) thus, they may be more willing to consume GMO foods..

### *Type of Product*

The hypothesis that people would be more accepting of GMO plants than animals was not supported. Previous research has shown that many people view plant and animal products in a different way and are more willing to consume GMO plants as opposed to animals (Marques et al., 2015). One explanation for these different results could be due to the different methodologies used. The Marques et al. (2015) study was a survey that directly asked consumers how comfortable they were with genetically modified

plants, while the present study's experimental approach might provide a more accurate picture of how people would actually react when they encounter GMO labels in a store.

### *Limitations and Future Study*

The present study's addition of a non-GMO label adds a new perspective to the studies of GMO food hesitancy. This study also approaches the topic of GMO hesitancy in a different light when compared to most other studies which feature surveys. Additionally, the difference in findings between women and men in this study with women being more hesitant towards GMO products may help pave the way for future research which can mostly target women when looking to improve GMO views. In a world where food is a pressing issue, GMOs are one of the best solutions: with their environmental benefits as well as health and cost benefits, improving GMO views would mean providing more food security to everyone and taking less of a toll on the environment, something that is becoming increasingly important.

For this study, there were only two products which were chicken and rice; however, GMO attitudes could differ depending on the product and therefore including more products could lead to more in-depth research. For future research, including fresh produce such as fruit and vegetables as well as other meats could be helpful.

Given that all the participants in this study were from the United States, the findings cannot be generalized to other nations. Since the issue of hesitancy towards GMOs is something that is seen worldwide, studying other areas and comparing them could help with determining which places to focus on when trying to improve the views on GMOs.

With the increasing amount of food insecurity in the world with our growing populations, GMO food is a promising way to accumulate a larger food supply to feed everyone (Genetically engineered foods, 2018). The

progress that could be made, however, is being held back by those skeptical about this technology. The results of this study have many interesting implications and could be used to help with further research in an impactful way. The finding that women were less willing to consume GMO products suggests that there is more work to be done among females in terms of lowering risk. As our need for a consistent and reliable food supply increases, GMO food remains the best option that can also be better for the environment.

## References

- Adhikari, B., & Cheah, P. Y. (2021) Vaccine hesitancy in the COVID-19 era. *The Lancet*, 21(8) 1086, [https://doi.org/10.1016/S1473-3099\(21\)00390-X](https://doi.org/10.1016/S1473-3099(21)00390-X)
- Amin, L., Jahi, J. M., & Nor, A. R. (2013). Stakeholders' attitude to genetically modified foods and medicine. *Scientific World Journal*, 2013(58), <https://doi.org/10.1155/2013/516742>
- Among U.S. couples, women do more cooking and grocery shopping than men (2019). Pew Research Center. Retrieved from <https://www.pewresearch.org/fact-tank/2019/09/24/among-u-s-couples-women-do-more-cooking-and-grocery-shopping-than-men/>
- Bansal, S., Chakravarty, S., & Ramaswami, B. (2013) The informational and signaling impacts of labels: Experimental evidence from India on GM foods. *Environment and Development Economics* 18(6), 701-722, <https://doi.org/10.1017/S1355770X13000326>
- Christen, C. (2021) Meat consumption in the U.S. is growing at an alarming rate
- Cui, K., & Shoemaker, P. S. (2018). Public perception of genetically-modified (GM) food: A nationwide Chinese consumer study. *NPJ Science of Food*. (2018) 2:10, <https://doi.org/10.1038/s41538-018-0018-4>
- Europe ambivalent on biotechnology. (1997) *Nature*. 387, 845-847 <https://doi.org/10.1038/43051>
- Genetically engineered foods. (2018). Medline Plus. Retrieved from <https://medlineplus.gov/ency/article/002432.htm>
- Kikulwe, E. M., Wesseler, J., & Falck-Zepeda, J. (2011). Genetically Modified Banana Survey Retrieved from PsycTESTS, <https://dx.doi.org/10.1037/t22207-000>
- Marques, MD., Critchley, C. R., & Walshe, J. (2015). Attitudes to genetically modified food over time: How trust in organizations and the media cycle predict support. *Public Understanding of Science*. 24(5) 601-618. <https://doi.org/10.1177/2F0963662514542372>
- Melore, C. (2021) Brain waves reveal why men take more risks than women. Study Finds. Retrieved from: <https://www.studyfinds.org/brain-waves-men-take-more-risks/>
- Moss, A., & Litman, L. (2021) Demographics of people on Amazon Mechanical Turk. Cloudresearch. Retrieved from: <https://www.cloudresearch.com/resources/blog/who-uses-amazon-mturk-2020-demographics/>
- Oselinsky, K., Johnson, A., Lundeberg, P., Holm, A. J., Mueller, M., & Graham, D. J. (2021) GMO food labels do not affect college student food selection, despite negative attitudes towards GMOs. *International Journal of Environmental Research and Public Health*. 18(4) 1761. <https://dx.doi.org/10.3390/2Fijerph18041761>
- Public opinion about genetically modified foods and trust in scientists connected with these foods. (2016). Pew Research Center. Retrieved from: <https://www.pewresearch.org/science/2016/12/01/public-opinion-about-genetically-modified-foods-and-trust-in-scientists-connected-with-these-foods/>
- Qaim, M. (2010) The benefits of genetically modified crops—and the costs of inefficient regulation. Resources. Retrieved from: <https://www.resource-smag.org/common-resources/the-benefits-of-genetically-modified-crops-and-the-costs-of-inefficient-regulation/>
- Rangel, G. (2015) From corgis to corn: A brief look at the long history of GMO technology. *Science in the News*. retrieved from: <http://sitn.hms.harvard.edu/flash/2015/from-corgis-to-corn-a-brief-look-at-the-long-history-of-gmo-technology/>
- Riezler, K. (1944) The social psychology of fear. *American Journal of Sociology*. 49(6) 489-498. 10.1086/219471
- Shahbandeh, M. (2021a) U.S. per capita meat consumption 2020 and 2030, by type. Statista. Retrieved from: <https://www.statista.com/statistics/189222/average-meat-consumption-in-the-us-by-sort/>
- Shahbandeh, M. (2021b) U.S. rice consumption 2008-2021. Statista. retrieved from <https://www.statista.com/statistics/255981/total-us-rice-consumption/>
- Widmar, N. J. O., Dominick, S. R., Tyner, W. E., & Ruple, A. (2017). When is genetic modification socially acceptable? When used to advance human health through avenues other than food. *PLOS ONE* 12(6) doi: <https://doi.org/10.1371/journal.pone.0178227>
- Yeh, D. A., Gomez, M. I., & Kaiser, H. M. (2019). Signaling impacts of GMO labeling on fruit and vegetable demand. *PLOS ONE* 14(10): <https://doi.org/10.1371/journal.pone.0223910>
- Zhang, Y., Jing, L., Bai, Q., Shao, W., Feng, Y., Yin, S., & Zhang, M. (2018). Genetically Modified Food Survey Retrieved from PsycTESTS. <https://dx.doi.org/10.1037/t66515-000>



# JOURNAL OF SECONDARY PSYCHOLOGICAL STUDIES

Submissions: All submissions to the Journal of Secondary Psychological Studies must be emailed to [jofsps@gmail.com](mailto:jofsps@gmail.com). Please visit our website <https://jofsps.weebly.com> for more information regarding our requirements and formatting preferences for submissions.

Feedback: We would love to hear any feedback on our journal. Help us improve our publication by emailing [jofsps@gmail.com](mailto:jofsps@gmail.com).

