Analysis of the Correlation Between Imposter Syndrome and Grade Level of Online High School Students

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Abstract

This project investigates the commonality and effect of imposter syndrome in the students of online high schools, using Stanford University Online High School (OHS) as a sample. Multiple scientific studies define imposter syndrome in similar ways, and it is estimated that 70% of people experience this phenomenon in their lives. However, imposter syndrome has rarely been investigated in such a young demographic before, nor in online school students, and therefore this project aims to spread awareness about the prevalence of imposter syndrome in online high school students. The variables include grade level, experiencing imposter syndrome, and where a student experienced it (at school, home, extracurriculars, etc.). The data sampled through an anonymous survey was investigated through 10 statistical tests: 9 chi-square tests, and 1 Kruskal-Wallis test. OHS students, on average, are statistically significantly more likely to experience imposter syndrome than the "average" person. However, the 7th and 8th-grade samples showed no statistically significant difference from the expected results. This data supports the alternative hypothesis that online high schoolers are more likely to experience imposter syndrome, which was reasoned to be due to the more difficult and higher amount of work, as well as the mounting pressure to achieve success.

Keywords
Imposter Syndrome, Online High School Students, Mental Health, Adolescents

1. Introduction
Imposter syndrome: the feeling of being a fraud, or imposter, in your own skin. Many people, of any age and gender, struggle with the effects of imposter syndrome, also known as the imposter phenomenon. This term was originally coined by psychologists Pauline Rose Clance and Suzanna Imes in 1978, in their article *The imposter phenomenon in high-achieving women: Dynamics and therapeutic intervention*. While not recognized in the official Diagnostic and Statistical Manual of Mental Disorders (DSM-5), imposter syndrome is defined by Merriam-Webster as "a psychological condition that is characterized by persistent doubt concerning one's abilities or accomplishments accompanied by the fear of being exposed as a fraud despite evidence of one's ongoing success."

Despite being frequently studied in adults, both young and old, and especially in the high achieving working and academic field, imposter syndrome is rarely studied in children and adolescents. As they transition from childhood to adulthood, adolescents face challenges in not only their physically growing bodies but also their developing brains. The effect of various factors on adolescent brains is often studied, such as social media, school, and more recently, the COVID-19 pandemic which has affected many people's mental health. However, students of online high schools face a unique challenge as they adjust to the different learning environment and increased social isolation, compared to those in traditional "brick-and-mortar" schools. Therefore, this project sets out to study imposter syndrome in online high school students and bring awareness to the prevalence of this phenomenon which appears to affect so many of these students, even more than the average world population.

2. Methods
Background research was conducted into the definitions and previous studies on imposter syndrome to clearly define what behaviors the survey would look for in the students. An anonymous Google Forms survey was used to collect non-parametric, nominal scale data. Null and alternative hypotheses were formulated to predict the results of the statistical tests.

2.1 Project Research

In order to define the behaviors which students with imposter syndrome would experience, research was done into articles, including previous scientific studies. As mentioned previously, the term "imposter phenomenon" was coined in 1978, supported by an excerpt from the abstract of *The imposter phenomenon in high-achieving women: Dynamics and therapeutic intervention*: "Numerous achievements, which one might expect to provide ample objective evidence of superior intellectual functioning, do not appear to affect the impostor belief." (Clance and Imes 1978)

A recent study on imposter syndrome defines imposter syndrome in a similar way, "Imposter syndrome—sensations of not belonging; feeling that one's competence and success are fundamentally fraudulent and inauthentic; the conviction of having somehow 'tricked' students, colleagues, peer reviewers, and publishers; and the fear that it is only a matter of time before this is discovered—is popularly understood as an individual—private—problem of faulty self-esteem" (Breeze 2018). Other studies on imposter syndrome include one which was "designed to examine perceived fraudulence, its measurement, and the personality traits associated with the experience in young adults." (Kolligian et. al 2010) Another from 2010 investigated the difference between the Clance Imposter Phenomenon Scale and the newly developed Perceived Fraudulence Scale (Sabine M. Chrisman et. al 2010).

A study from the International Journal of Behavioral Science states that, "it is estimated that 70% of people will experience at least one episode of this phenomenon in their lives." (Sakulku J et. al 2011) This estimated percentage was used as the basis for the "expected" results in the statistical tests. In addition to these studies, VeryWellMind, a website partnered with The Cleveland Clinic to provide mental health information, was used to outline the questions asked in the survey. The survey collected data from 111 students of Stanford Online High School.

Stanford Online High School was chosen as a representative sample because it "is a highly selective independent school...for students in grades 9-12...with a rigorous curriculum." This combination of factors, such as the fact that its courses are fully online, it includes 7th and 8th graders, and is selective and rigorous in its academics, made OHS the ideal sample of high-achieving students who deal with the challenges of adolescence and online schooling all at once.

2.2 Hypotheses

The null hypothesis is that there would be no statistically significant difference between the estimated average that 70% of the population experiences imposter syndrome and the actual results gathered from the OHS students. The alternative hypothesis is that there is a statistically significant difference between the two. As mentioned previously, OHS has an environment of rigorous academics and high-achieving students can lead to a higher pressure to achieve than in the "average" world. Additionally, comparing oneself to others, especially the highly skilled students of OHS, will lead to imposter syndrome. The second hypothesis was that older students are more likely to have experienced imposter syndrome, which could signify 1) higher stress levels (perhaps from college applications or more difficult courses), 2) more work, or 3) simply because they've had more time in life to experience those feelings.

2.3 Data Collection

A Google Forms survey was used to collect the data and was kept anonymous as this would elicit more honest responses and encourage more people to answer without fear of judgment or pressure to answer a certain way. The survey was also limited to only OHS students, at any grade level, by sending it out to all OHS students through the Skype message app. The survey only collected data from those students who were active on Skype at the time and who chose to participate. The survey was first sent out on January 31st and early February. This first round received 75 responses, and there were an additional 36 responses from the second round in April/May, for a total of 111 responses, which represents about 12-14% of the total student population, an adequately sufficient sample to represent students from each grade level.

A factor that was unable to be controlled due to the large time span of data collection is how stress levels/feelings of imposter syndrome can fluctuate throughout the school year. The first round of January/February came a few weeks after winter break so that students' feelings of imposter syndrome were lower during this time period than during April and May which are the months near final exams. Even though uncontrolled variables could lead to less reliable results, this wide span of time also has the advantage of making the data more representative of the overall school year.

According to Very Well Mind, some causes of imposter syndrome are bullying, peer pressure, criticism and judgment from family, periods of low success, and too much work. The common effects which were also included in the survey,

were: self-doubt, a feeling of exclusion, fear of criticism, overworking oneself, comparing oneself to others, brushing off praise as "untrue", fear of being found out as a "fraud" or imposter, self-criticism of flaws or mistakes, and attributing success to luck rather than hard work.

The survey had 3 multiple-choice questions, each one investigating one of the three important variables. The first was "What grade are you in?" with options of 7th, 8th, 9th, 10th, 11th, and 12th grade. Out of the 111 responses, there were 4 seventh-graders, 18 eighth-graders, 32 freshmen, 24 sophomores, 19 juniors, 14 seniors. This variable should have been more controlled so there would be a more even distribution of grade levels and a better representation of each, especially since there was such a small sample size of 7th-graders. Perhaps, the survey could have been sent through email, where it is more likely that students will see the survey and participate, rather than through Skype.

The second question was "Have you ever felt Imposter Syndrome in your life?" For this, the options: Yes; Not at all (suggested to put N/A for the next questions); Other (where students could elaborate if they would like to). There was also an "I wish not to answer" option, which was present on all questions, but it was not chosen by anybody for this question. Because it is estimated that 70% of the population have experienced imposter syndrome at least once, only Yes and No options were put, instead of a specific number of times. The Other option counted as "Yes" in all statistical tests since the answers given were positive, though with elaboration.

The final question was "Where and when did you feel the imposter syndrome?" For this, the options were: At a school before OHS; At OHS; Outside of school (in extracurriculars); At home; I wish not to answer; N/A; and Other: _____. These options cover a variety of specific locations where students could be present during their day, and which could influence their mental health, whilst remaining broad enough to apply to all students.

For these last two questions, multiple different options could be chosen. To evaluate all this data, the data was organized into a Google Sheet. The =countif(s) function and several pages were used to organize the data into tables so the individual responses to each question could be investigated.

3. Data and Statistical Analysis

Pie charts, bar charts, and tables are all used to represent the data collected. 2 different types of statistical tests were run to investigate the statistical significance, or lack thereof, of the results.

3.1 Data Presentation

As the categories of grade level or specifics on imposter syndrome are discrete, unranked, and mutually exclusive, tests for nominal data were run. In this case, it is assumed that grade level is the dependent variable whilst the feeling and/or location of imposter syndrome is the independent variable. Because the grade level distribution is uneven, and therefore unlikely to be normally distributed, non-parametric tests were run.

9 different chi-square tests for "goodness of fit" were run. The second type of test was a Kruskal-Wallis test which is used to find a statistically significant difference, or lack thereof, between 3 or more groups that are non-parametric, and which have nominal scale data.

The pie chart (Figure 1) below displays the percentage each grade level takes up of the total sample. This demonstrates the uneven grade distribution which is an uncontrolled factor that must be taken into consideration during analysis.

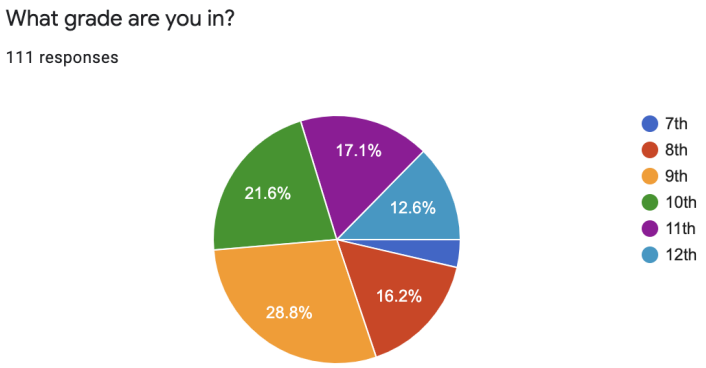

Figure 1. Pie Chart showing the distribution of grade level

A second pie chart (Figure 2) showing the distribution of the answers to the question "Have you ever felt Imposter Syndrome in your life?" This already shows that the distribution of OHS students who have experienced imposter syndrome, 89.2%, is greater than the expected percentage of 70%.

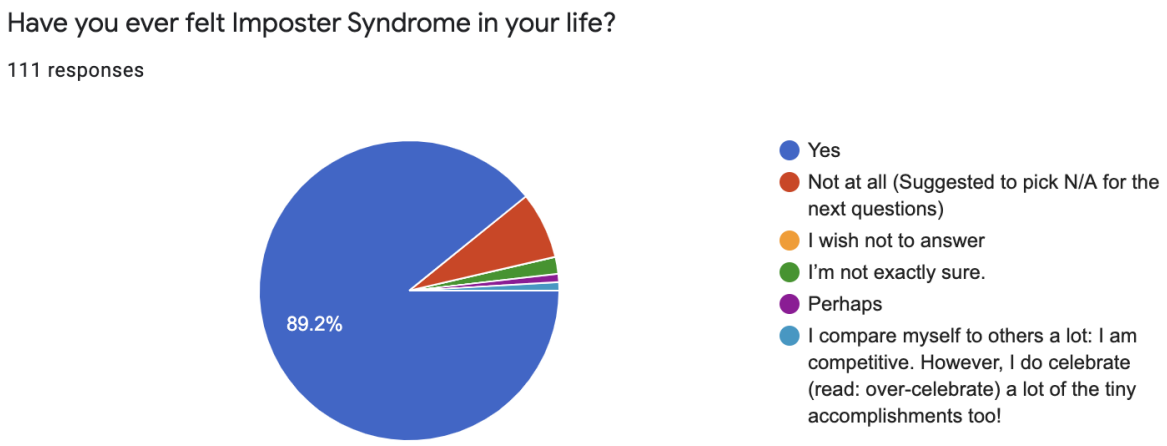

Figure 2. Pie Chart showing how many students have experienced imposter syndrome

A table was created (Table 1) that shows all the total numbers as well as the answers to the question of "Have you ever felt Imposter Syndrome in your life?" sorted into categories of grade level and type of answer.

Table 1. Showing the actual results from the survey

Figure 1A	Total Numbers	YES "Have you ever felt Imposter Syndrome in your life"	NO "Have you ever felt Imposter Syndrome in your life"	OTHER "Have you ever felt Imposter Syndrome in your life"
Total	111	99	8	4
7th	4	1	3	0
8th	18	15	3	0
9th	32	27	1	4
10th	24	23	1	0
11th	19	19	0	0
12th	14	14	0	0

Based on the actual numbers and the estimate that 70% of people experience imposter syndrome, another table (Table 2) was created, which highlights its differences from Table 1 in blue. These blue numbers are the expected frequencies of 70% in each category, which were used in the chi-square tests for "goodness of fit". As previously mentioned, these expected frequencies are taken from a study from the International Journal for Behavioral Science (Sakulku J et. al 2011).

Table 2 showing the expected frequencies (70%) in blue

Approxiamtely expected results, not real!			
Figure 1B	Total Numbers	YES "Have you ever felt Imposter Syndrome in your life"	NO "Have you ever felt Imposter Syndrome in your life"
Total	111	78	33
7th	4	3	1
8th	18	13	5
9th	32	22	10
10th	24	17	7
11th	19	13	6
12th	14	10	4

The third variable which was considered was where the feelings of imposter syndrome arose for the student, asked by the question, "Where and when did you feel the imposter syndrome?" Because this question had multiple options, as well as the choice to choose several of these options, it was rather tricky to find a way to compare these answers with grade level. Ultimately, the =countif(s) function was used to find out how many students fit into very specific categories, such as Only at OHS or At OHS and Outside Of School (in extracurriculars). From this, 14 small tables were created. The most common answer was Only at OHS, showing that the most common experience is for OHS students to have only experienced imposter syndrome as a result of being at OHS. The second most common answer combination was OHS, Before OHS, Extracurriculars, Home (ie. 20 students chose all four options). The third most common answer combination was At OHS and Extracurriculars. The fourth most common answer combination was OHS, Before OHS, Extracurriculars. The data from the four most common combinations of answers was used for the Kruskal-Wallis test.

The final chart is a bar graph (Figure 3) that shows the distribution of the answers to "Where and when did you feel the imposter syndrome?" This shows the most common answers to this question, which can be broken down into the combinations mentioned previously.

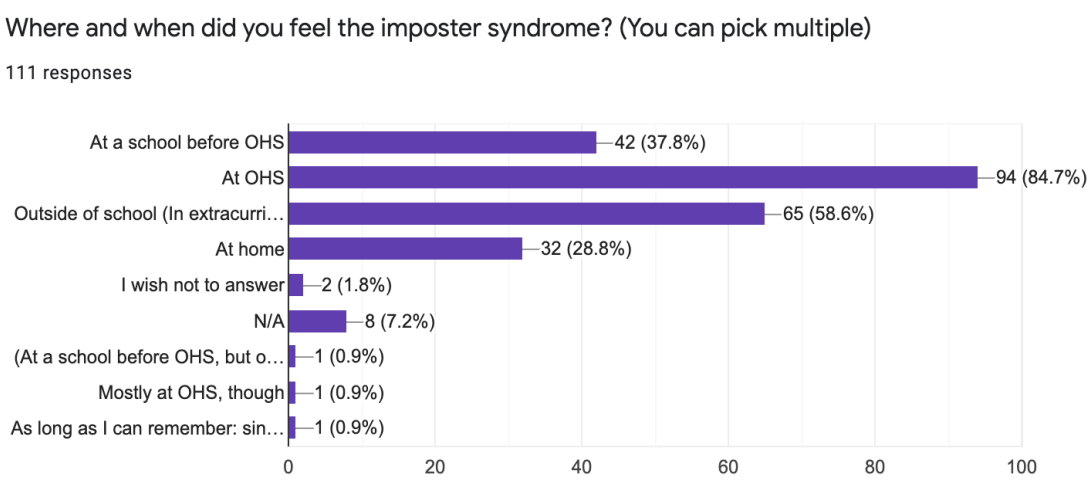

Figure 3. Bar Chart showing the distribution of answers to the third question.

3.2 Chi-Square Tests

First, chi-square tests for "goodness of fit" were run multiple times to compare the expected and observed results for the question of "Have you ever felt Imposter Syndrome in your life?" These tests were categorized using a letter and number, depending on what type of data it was comparing. Table #1 shows the "expected" numbers of Yes and No, going off the estimated statistic of 70% Yes from the International Journal of Behavioral Science (Sakulku J et. al 2011).

The first two runs of chi-square tests (A1 and A2) compare the observed and expected results for Yes and No across all grades, and the total. Next, 7 chi-square tests with smaller sample sizes were run, also for "goodness of fit" to compare the expected and observed results across each grade level and for the total sample. The "Other" results in the Total and 9th-grade answers were added to the "Yes" answers, as an expected answer of 0 would result in a chi-square value of infinity. Because of this, each of the B1-B7 tests had degrees of freedom=1, which required Yate's correction to be applied through VassarStats automatically. Because there were only 4 answers from 7th-graders, this data may not be representative of the population due to its very small sample size, while the other 5 grades had at least 14 respondents.

To compare the statistical significance of chi-square tests A1, A2, and B1-B7, all the values were put into a table, color-coding to show the level of statistical significance. Red indicates insignificance, yellow indicates significance, and green indicates high significance. This is shown below (Table 3). Here we can see that 7 out of 9 of these chi-square tests are statistically significant, including 2 statistically highly significant ones.

Table 3. Showing the results of the 9 chi-square tests

Name of Chi-square test	Comparison	Chi-square value	P-value	Level of Significance
A1	Yes	14.92	0.0209	Significant
A2	No	46.98	<0.0001	Highly Significant
B1	Total	25.89	<0.0001	Highly Significant
B2	7th	3	0.0833	Not Significant
B3	8th	0.62	0.431	Not Significant
B4	9th	10.51	0.0012	Significant
B5	10th	6.1	0.0135	Significant
B6	11th	7.37	0.0066	Significant
B7	12th	4.29	0.0383	Significant
Not significant				
Significant				
Highly significant				Figure 16

3.3 Kruskal-Wallis Test

Finally, a Kruskal-Wallis test was run to find if there is a significant difference between the number of people in each grade level who experienced imposter syndrome in a certain location. For this test, the four most common answers were taken and compiled into the table below (Table 4). The Kruskal-Wall test resulted in a p-value of 0.5519, showing that there is no statistically significant difference between the location of feeling imposter syndrome and how many students answer per grade level.

Table 4. Showing the breakdown of the four most common answer combinations to the third question.

Figure 17	Only at OHS	OHS, Extracurriculars	OHS, Before OHS, Extracurriculars, Home	OHS, Before OHS, Extracurriculars
7th	0	0	0	1
8th	3	1	4	3
9th	5	8	8	4
10th	6	5	4	2
11th	4	3	3	2
12th	7	3	1	2

4. Conclusion

Overall, the students of Stanford Online High School demonstrated a statistically significant difference in the presence of imposter syndrome compared to the estimated average of 70% per population. When looking at the question of "Have you ever felt Imposter Syndrome in your life?", the positive "Yes" answers across all grade levels, and the total, showed a statistically significant difference from the norm. The negative "No" answers across the total and grade levels demonstrated a statistically highly significant difference from the expected results. From this, we can see that OHS students, on average, are much more likely to experience imposter syndrome than the "average" person. This indicates that the null hypothesis can be rejected, and the alternative hypothesis accepted.

However, once we break these results down by grade level, we see different results, some statistically significant and others not, a phenomenon similar to Simpson's Paradox. The 7th and 8th-grade samples showed no statistically significant difference from the expected results. However, all the high school students' results (9th-12th grade) demonstrated a statistically significant difference from the expected results, as the observed number of "Yes" answers were much higher than the expected rate of 70%.

A conclusion can be drawn that OHS middle school students experience less imposter syndrome than OHS high school students, as being at OHS has not yet influenced their likelihood to develop those feelings. This supports the alternative hypothesis again and likely demonstrates that high schoolers are more likely to experience imposter syndrome, potentially caused by the more difficult courses and higher amount of work, as well as the greater pressure to achieve as they near adulthood. However, it may not show that the alternative hypothesis, that all OHSers are more likely to do so than the "average" person, is more likely to be true.

Additionally, the Kruskal-Wallis test showed that there was no statistically significant difference between how many students answered per grade level and the location they chose, based on the 4 most common combinations of answers. No matter where they have experienced the imposter syndrome, there is approximately the same number of people per grade level who chose each location.

Because Stanford Online High School students demonstrate a higher likelihood of experiencing imposter syndrome, other online high school students may as well, and awareness about the prevalence of this issue in adolescents should be spread to help the students counteract and cope with the imposter syndrome.

5. Future Research

Finally, if this project was redone, several aspects would be changed to control more variables, as well as to run more statistical tests. First, all the survey answers should be from an average-workload period, perhaps across two weeks, so that there is not too much fluctuation in student's emotions based on approaching finals or a recent break. Secondly, an even greater sample size would be gathered, especially of 7th-graders, so that the sample results may more accurately represent the whole population. Even within the three variables which were investigated in this project, there are many more opportunities to run statistical tests. For example, Kruskal-Wallis tests could be run to compare each grade level's answers to "Have you ever felt Imposter Syndrome in your life?", or even just between high school students or middle school students (Mann-Whitney for two samples). There were many other variables involved in my survey which were not subjected to statistical testing, such as the various causes and effects of imposter syndrome, as well as whether the student has found someone to help them cope, and who this is. A further investigation into this would be both interesting and beneficial to find the root of these issues and more effective ways to deal with them.

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Biography

Ester Weinhardt is a student at Stanford Online High School. She has previously won two silver medals at the Riverside County Science and Engineering Fair (2019 and 2020). Her interests include literature and psychology, their connections in the field of psycholinguistics, and how this can better help us understand human communication and mental health.