The Influence of AI Chatbots on Education

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Appendix

Abstract

The era of AI has become the axis of the universe these days since AI is shaping the future of the world across several different industries and it's holding many surprises for the next generation. AI enables chatbots to interpret natural language by combining several techniques behind the scenes. The impact of AI chatbots like ChatGPT is very significant in several fields, especially education. The purpose of this report is to illustrate the influence of AI chatbots especially in education and how it can be used in a meaningful way. For instance, explaining how the academic environment can take advantage of ChatGPT through teaching the students how to use it on the right path instead of banning it. Besides, discussing the performance of ChatGPT for math and statistics, as well as measuring its strength in these fields. Also, the statistical charts associated with the resources demonstrate the proportion of using ChatGPT in schools by several categories. Furthermore, the recommendation regarding using ChatGPT for educational purposes depends on the student's specific needs and objectives.

Keywords: AI Chatbots, ChatGPT, Education.

Introduction

The idea of a robot having the ability to perform human tasks, from chatting to solving complex equations, is quite scary. According to Stephen Hawking "The rise of powerful AI will be either the best, or the worst thing, ever to happen to humanity. We do not yet know." At this point, it's early to make a judgment or prediction about the impact of AI on humanity or decide if it's ultimately bad or good because people are still discovering it, but we can estimate the consequences of using it in specific fields like education. In general, the integration of technology in our lives always holds so many surprises, allowing us to delve deeply into our imagination of the future magic of technology. For example, the flying car was one of the most anticipated advancements in the first of the 21st century. Furthermore, technology has both positive and negative aspects, so there will always be trade-offs, and this trade-off applies to AI as well. AI is the brief of Artificial Intelligence, wherein machines have the ability to perform tasks associated with human cognition over wider domains. The behind-the-scenes of AI involves data, which serves as its fuel. AI learns and trains on huge amounts of data, then processes algorithms to capture the patterns within the data, enabling it to perform tasks with efficiency. Moreover, AI Chatbots like ChatGPT is one of the AI applications that is most frequently used in our recent age. The impact of ChatGPT on the academic environment is becoming significant, with many students depending on it to complete their assignments. For example, they use it for writing essays or solving math equations. In the long term, this dependence can be considered an educational disaster because it may result in a whole generation that lacks the ability to write even a single-page essay, as they rely on plagiarism tools. Additionally, the simplicity and accessibility of ChatGPT appeal to students, leading them to seek answers from it rather than generating their own. Despite this, banning ChatGPT is not the solution, as students will likely find other ways to access similar tools. Exploring the variety of ChatGPT's useful tools for students can transform the typical routine and create a more engaging environment. This approach would likely encourage students to utilize ChatGPT in the right way. Generating ideas for their English essays, creating review quizzes for their math tests, and practicing scoring the exams are some of the many useful tools that ChatGPT offers, which school faculties can take advantage of.

Research and Finding

ChatGPT is going to change the education, not destroyed it

The most frequent mistake that many schools made across the country and outside was considering ChatGPT solely as a cheating tool, without addressing its potential benefits. Consequently, their reaction was to block students from accessing it immediately. "By January, school districts across the English-speaking world had started banning the software, from Washington, New York, Alabama, and Virginia in the United States to Queensland and New South Wales in Australia." Also, the students will somehow find a way to access ChatGPT, and if so, the schools have failed in this case. However, the fact that schools must acknowledge and accept is that ChatGPT has become a reality in the world of education. Based on this, schools should consider how students can use ChatGPT in the right direction by following several steps. Given ChatGPT's extensive capacity from writing argumentative essays or even articles to solving complex coding questions, as well as the easy access to it, it's reasonable for schools to panic initially. But nowadays many educators start looking to the ChatGPT from a different aspect and believe that it can improve education, far from just being a dream machine for cheating. "Emily Donahoe, a writing tutor and educational developer at the University of Mississippi, asked her students to use ChatGPT to generate an argument and then had them annotate it according to how effective they thought the argument was for a specific audience. Then they turned in a rewrite based on their criticism." This can help the students to focus on their critical thinking skills rather than generating random ideas. Smith, the bioscience professor, is trying out ChatGPT assignments. Since students are stuck at home, teachers needed assignments that couldn't be quickly found on Google. But Smith realized that searching— knowing what to look for and how to understand the results—was a skill worth teaching. He thinks chatbots could be the same. Besides, teachers often ask students to utilize ChatGPT by generating brief paragraphs on various topics such as history or theory, and then analyzing them to draw conclusions. "Chatbots also serve students who have specific learning needs, too. Ask ChatGPT to explain Newton's laws of motion to a student who learns better with images rather than words." Through various applications, we see how ChatGPT can infuse classrooms with interactivity and positive vibes.

ChatGPT for Math and Statistics

While ChatGPT demonstrates high efficiency in writing essays on various topics in a few seconds, its performance in math is quite different. Solving math equations with ChatGPT depends on the complexity of the equation. For instance, solving algebraic equations using ChatGPT is not like proofing mathematical theorems. "It thus seems fair to say that (Chat)GPT is inconsistently bad at advanced mathematics: While its capabilities generally drop with the mathematical difficulty of a prompt, it does give insightful proofs in a few cases." "Moreover, using ChatGPT for statistics is helpful in illustrating the ideas behind statistical methods and providing real examples of what works for and when should we use these methods. However, solving statistical problems also depends on the complexity of the equations. While it can easily handle simple descriptive statistics, it may struggle with more advanced statistical analyses like the Chi-square test, but it can explain what the aim of it is clearly.

Percentage of College Students Have Used AI in Assignments or Exams

A survey conducted by BestColleges included one thousand undergraduate and graduate students to gather their viewpoints on this new powerful technology ChatGPT. The surprising part of the result of this survey is that 41% of students said that they haven't used it, while 56% of students said that they did, and 4% preferred not to answer.

Student Responses on the Use of AI

■ Yes   ■ No   ■ Prefer Not to Say/I Don't Know

| I use or have used AI tools to help complete assignments or exams. | 56% | 41% | 4% |

Figure 1

Using ChatGPT depends on several factors, one of the most important being the field of study. On the other hand, the generation of the students and their gender can also be considered as factors.

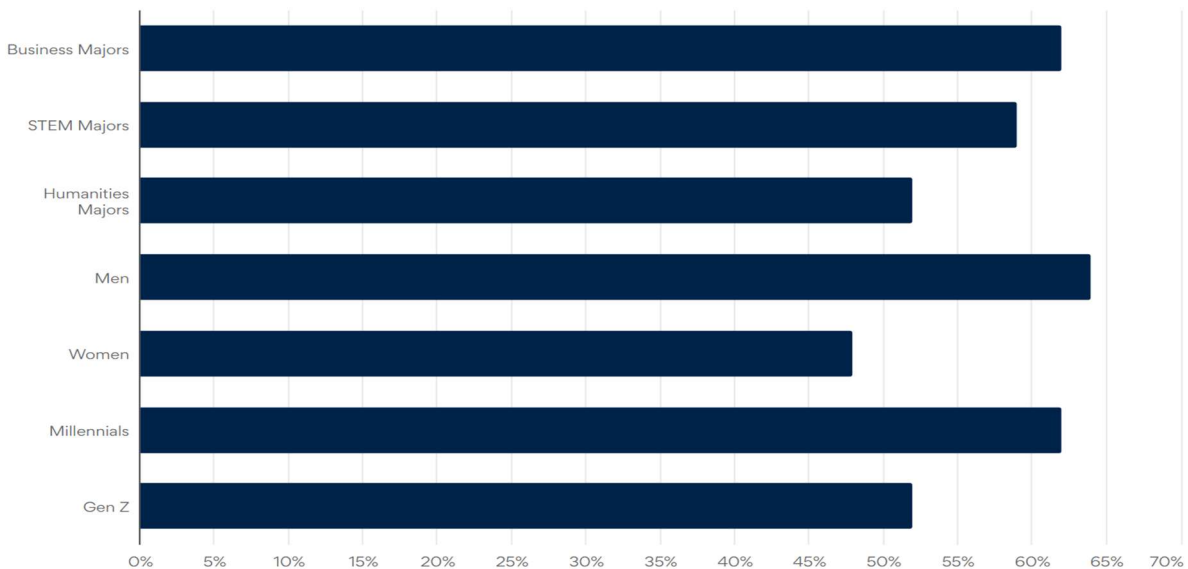**College Student AI Use by Major, Gender, and Generation**

Figure 2

According to the chart that is shown above, Business majors (62%) are more likely to use AI tools like ChatGPT for assignments or exams than humanities majors (52%), with STEM majors falling in between at 59%. Also, it shows a significant difference between men 64% vs. women 48% using ChatGPT to complete their assignments. The reason behind this difference may be that men comprise a higher percentage of those pursuing degrees in business and STEM fields compared to women. "In our survey, 1 in 5 men (20%) were business majors compared to 16% of women." Besides, Millennial students use AI tools like ChatGPT for assignments/exams more than Gen Z students (62% vs. 52%).
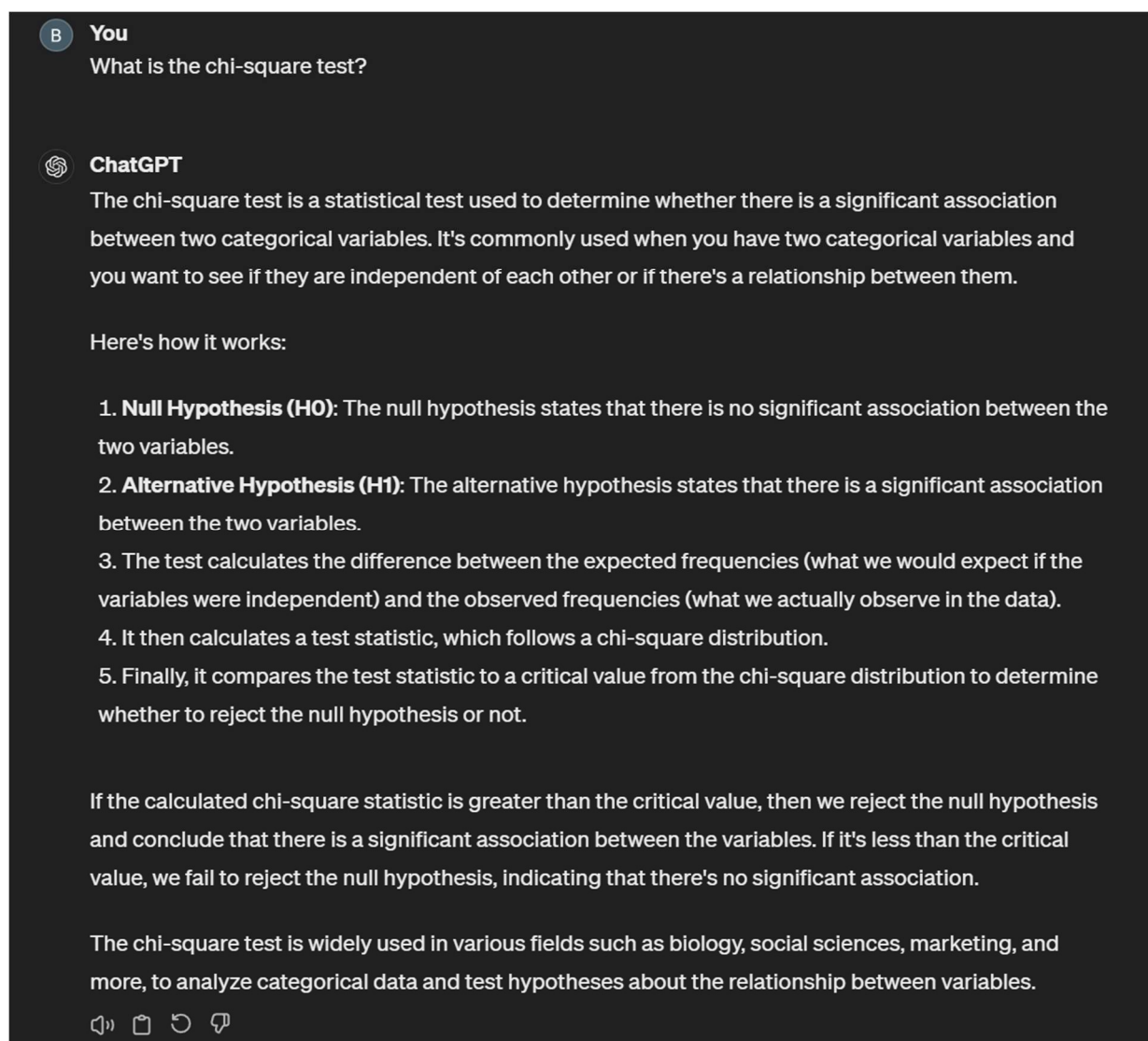
Personal Experience

Figure 3

I asked ChatGPT about the chi-square test, one of the statistical tests, and it explained it to me very clearly by providing the definition, what it's used for, and when, the steps to conduct it with explanations of each step, and lastly, a summary of it. But the irony here is ChatGPT can't show efficacy in solving problems related to this test. Here's an example from Penn State University with the solution,

Example S.4.1

Is gender independent of education level? A random sample of 395 people was surveyed and each person was asked to report the highest education level they obtained. The data that resulted from the survey are summarized in the following table:

	High School	Bachelors	Masters	Ph.d.	Total
Female	60	54	46	41	201
Male	40	44	53	57	194
Total	100	98	99	98	395

Question: Are gender and education level dependent at a 5% level of significance? In other words, given the data collected above, is there a relationship between the gender of an individual and the level of education that they have obtained?

Hide Answer

Here's the table of expected counts:

	High School	Bachelors	Masters	Ph.d.	Total
Female	50.886	49.868	50.377	49.868	201
Male	49.114	48.132	48.623	48.132	194
Total	100	98	99	98	395

So, working this out, $\chi^2 = \dfrac{(60 - 50.886)^2}{50.886} + \cdots + \dfrac{(57 - 48.132)^2}{48.132} = 8.006$

The critical value of χ^2 with 3 degrees of freedom is 7.815. Since 8.006 > 7.815, we reject the null hypothesis and conclude that the education level depends on gender at a 5% level of significance.

Figure 4

And here's how ChatGPT solved the same problem,

Figure 5

The first and the second steps were accurate,

Next, let's calculate the expected frequencies assuming independence:

1. Calculate the row totals for each gender (Female and Male), and the column totals for each education level.
2. Use these totals to calculate the expected frequency for each cell by multiplying the corresponding row total by the corresponding column total, and then dividing by the overall total.

Expected frequency (for each cell) = (row total * column total) / overall total

Now, let's calculate the expected frequencies:

	High School	Bachelors	Masters	Ph.d.	Total
Female	50.88	49.84	50.28	49	201
Male	49.12	48.16	48.72	49	194
Total	100	98	99	98	395

Figure 6

Here are the calculations:

For the cell (Female, High School):
(observed – expected)^2 / expected = (60 – 50.88)^2 / 50.88 ≈ 1.07

For the cell (Female, Bachelors):
(observed – expected)^2 / expected = (54 – 49.84)^2 / 49.84 ≈ 0.44

For the cell (Female, Masters):
(observed – expected)^2 / expected = (46 – 50.28)^2 / 50.28 ≈ 0.90

For the cell (Female, Ph.d.):
(observed – expected)^2 / expected = (41 – 49)^2 / 49 ≈ 1.53

For the cell (Male, High School):
(observed – expected)^2 / expected = (40 – 49.12)^2 / 49.12 ≈ 1.65

For the cell (Male, Bachelors):
(observed – expected)^2 / expected = (44 – 48.16)^2 / 48.16 ≈ 0.45

For the cell (Male, Masters):
(observed – expected)^2 / expected = (53 – 48.72)^2 / 48.72 ≈ 0.42

For the cell (Male, Ph.d.):
(observed – expected)^2 / expected = (57 – 49)^2 / 49 ≈ 1.80

Now, sum up all these values:

Chi-square ≈ 1.07 + 0.44 + 0.90 + 1.53 + 1.65 + 0.45 + 0.42 + 1.80 ≈ 8.26

Figure 7

But here we can see that ChatGPT failed in calculating the right degrees of freedom.

Now, we need to find the critical value for a chi-square distribution with $(4-1) \times (4-1) = 9$ degrees of freedom, at a 5% significance level.

Consulting a chi-square distribution table or using a statistical software, we find the critical value to be approximately 14.07.

Since our calculated chi-square value (8.26) is less than the critical value (14.07), we fail to reject the null hypothesis. Therefore, there is not enough evidence to conclude that there is a significant relationship between gender and education level at the 5% level of significance.

Figure 8

The degrees of freedom formula for the chi-square test is calculated using the following:

$$df = (\# \text{ of rows-1})*(\# \text{ of columns-1})$$

With 2 rows (male and female) and 4 columns (High School, Bachelor's, Master's, and PhD), the degrees of freedom are calculated as *df = (2-1) * (4-1) = (1) * (3) = 3.* Yet, somehow, ChatGPT calculated 4 rows instead of 2.

The aim of this test is to decide on the hypothesis, either rejecting it or not. In this example, we aim to determine if education level depends on gender or not. The null hypothesis posits that there is no dependency between education level and gender. However, the correct conclusion is to reject the null hypothesis, indicating that the level of education does indeed depend on gender. However, what ChatGPT generated is a failure to reject the null hypothesis, suggesting no dependency. ChatGPT made a small mistake by calculating 4 instead of 2, but this error is significant for statisticians because the crucial aspect lies in drawing the correct conclusion. If we misinterpret the results of the chi-square test, we will make an incorrect decision.

Recommendation

As shown in Figure 1, the majority of the students have used ChatGPT for their assignments, highlighting the role of AI chatbots becoming a tool in the student's daily life. We can generate some versions of AI chatbots that can be valuable educational resources for students. The students' needs in using ChatGPT for educational purposes depend on several factors, with one of the main factors being the classes they are taking. Since each class requires a different approach and set of skills, for instance, in English assignments such as writing, what can help students are articles and books that give them ideas on how to start writing and support their arguments in their essays. Therefore, a new generation of AI chatbots like Book GPT or Article GPT can provide students with articles and books associated with the topic they are writing about. Furthermore, Book GPT would be helpful for math classes as well, where it can provide students with the best version of math textbooks suitable for their level of study. Additionally, since ChatGPT failed to solve the statistical problem as shown in Figure 8, and in my opinion, this failure can be considered a blessing. Nonetheless, students can still utilize it in different ways. For instance, many students prefer watching math lessons, so Lessons GPT would also be beneficial because it can suggest platforms offering math lessons aligned with what they are learning. Language GPT for non-English speakers would be very helpful in generating great expressions for students.

Conclusion

Opinions regarding the influence of AI chatbots are varied while some people believe that ChatGPT is just a more advanced version of Google. However, if we were to assess Google solely from one perspective in the past, it would likely have faced bans today, and we'll be the losers. Google also offers numerous educational benefits for our learning journey, but at the same time, it gives students access to many cheating platforms. "It is essential for educational institutions to strike a balance by providing guidance on responsible use, and emphasizing the importance of independent thought." Addressing the potential risks associated with every new powerful technology and studying how to transform these risks into features is essential for achieving success. Besides, ChatGPT may not work the same for all fields, for instance, ChatGPT lets the students use their critical thinking by generating biased ideas on specific topics. As well as, illustrating the idea behind mathematical or statistical concepts, considering that there's no guarantee of solving problems associated with these concepts. The utilization of ChatGPT in education depends on several factors, with the primary factor being the student's major; students in complex majors are more likely to utilize it than those in easier majors.

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