

**Final Report**

**Big Data Analysis**

**Semester 1, Year 2025**

**Team SG**

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**Big Data Analysis on the Impact of COVID-19 on Educational Technology**

**Adoption in South Korean Universities**

### **1.Introduction**

South Korea has one of the strongest education systems in the world, which includes 12 years of school and 4 years of university. Higher education in South Korea is highly competitive, and both university students and professors are known for their hard work and discipline. However, like the rest of the world, the COVID-19 pandemic had a serious impact on the traditional university classroom system. Due to the sudden lockdowns and restrictions, universities were forced to continue education through online platforms. It was a big change, and not everyone was ready for it at the beginning. Professors had to learn how to manage virtual lectures, and students had to adapt to learning from home. Internet connection problems, device limitations, and lack of digital skills were just a few of the challenges that appeared. But despite all of that, South Korea adapted fast. The government, universities, and tech companies worked together to support digital learning. Platforms like EBS and Zoom were widely used, and soon online learning became the new normal. Technical problems were solved over time, important data was collected, and better systems were developed. As a result, South Korea now has one of the most developed educational technology environments in the world.

In this project, we are using big data to analyze how EdTech developed during and after the COVID-19 period in South Korean universities. The goal is to understand what changed, what improved, and how students and professors reacted to the new way of learning.

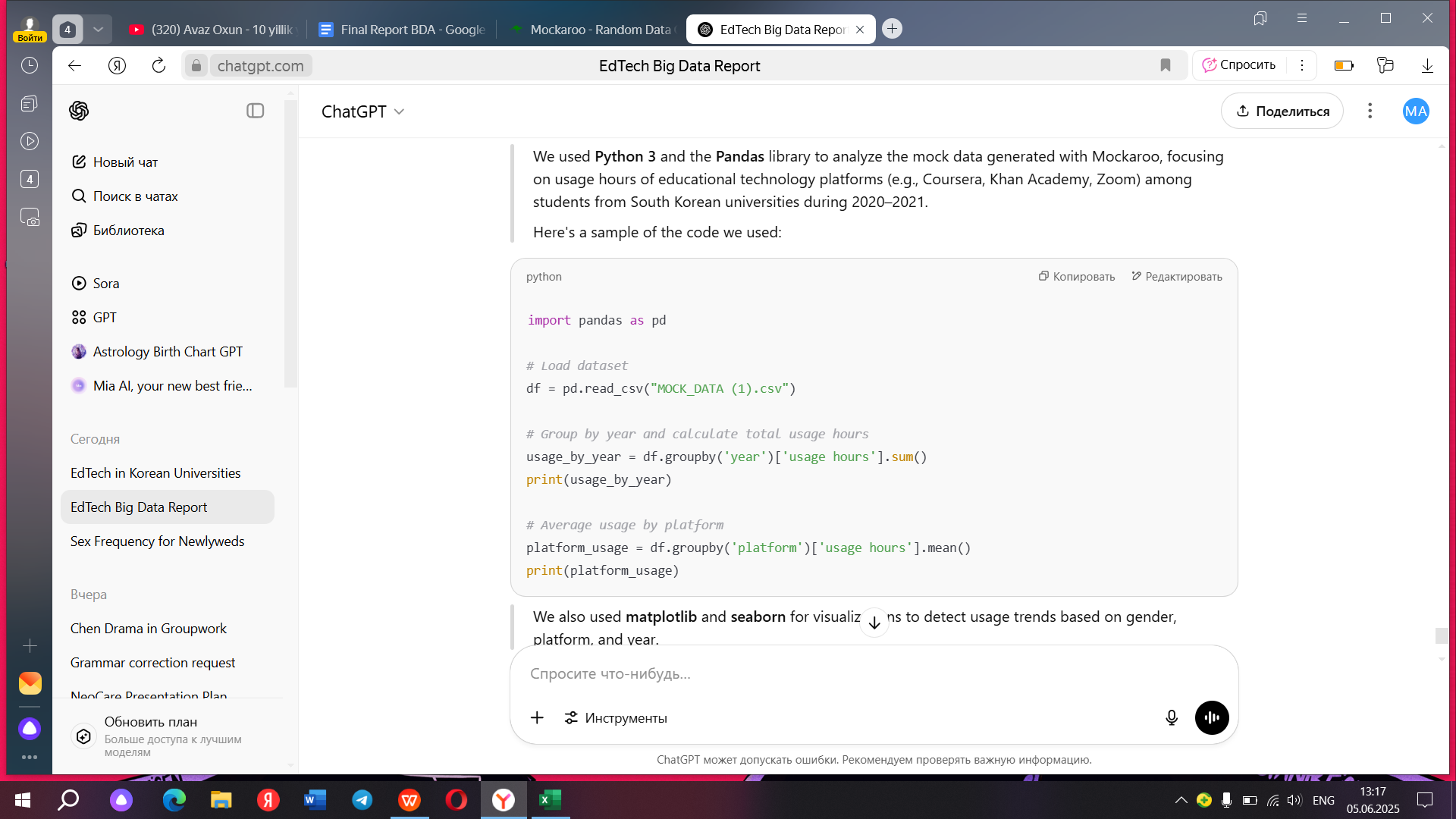
### **2.Implementations**

To carry out this project, we followed several steps starting from data collection to final analysis. Our main goal was to explore the impact of COVID-19 on the usage and development of educational technology in South Korea, especially in universities.

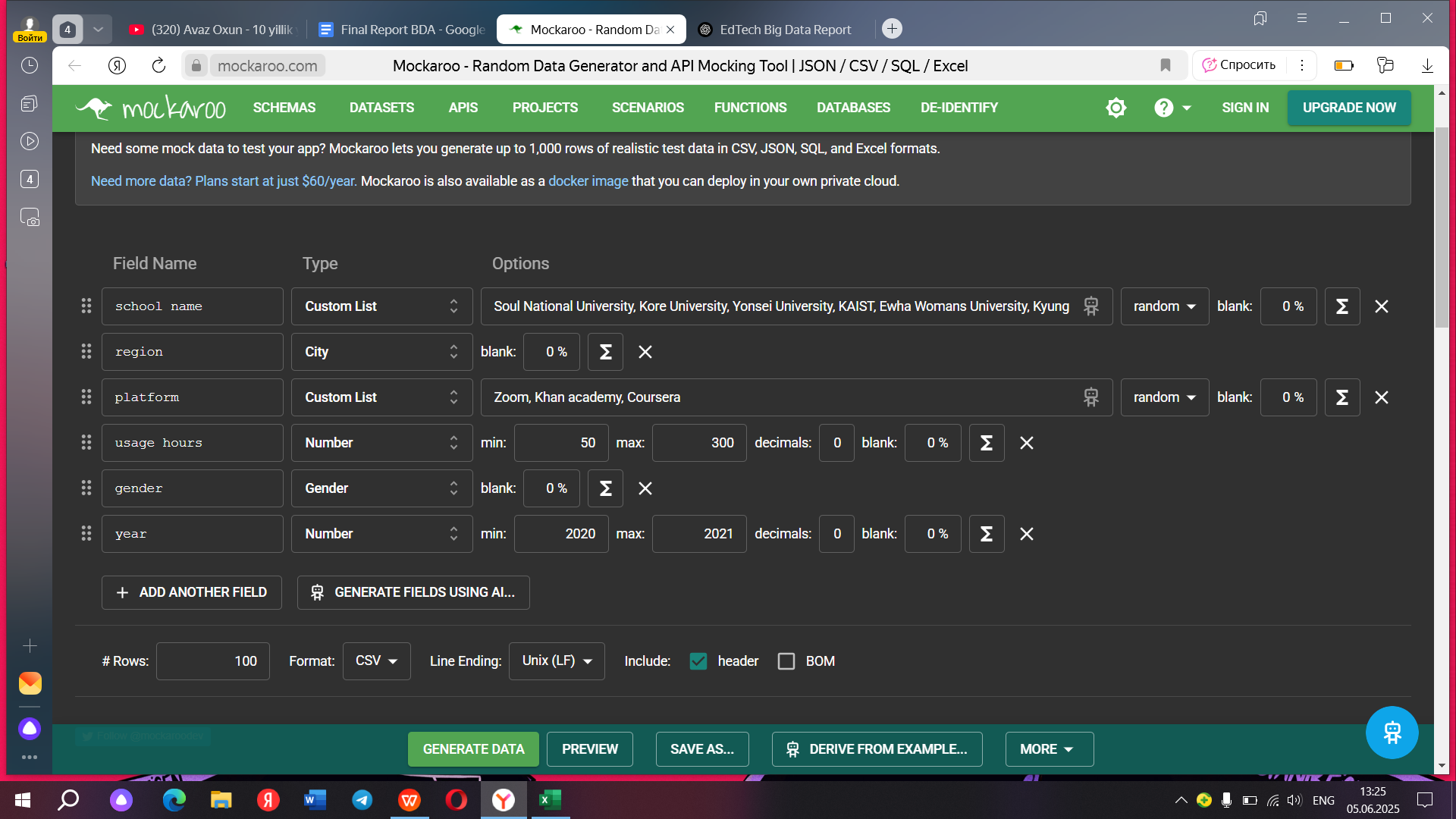
We used Python 3 and the Pandas library to analyze the mock data generated with Mockaroo, focusing on usage hours of educational technology platforms, such as Coursera, Khan Academy and Zoom among students from South Korean universities during 2020-2021. And here you can see how they dramatically grew in one year and for better comparison we added years since 2020 to 2025 in our table:

| **Platform** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** |
| --- | --- | --- | --- | --- | --- | --- |
| *Zoom* | 4.5 | 6.2 | 5.1 | 4.3 | 3.8 | 3.2 |
| *Coursera* | 2.1 | 4.5 | 5.0 | 5.3 | 5.6 | 5.9 |
| *101 Edu* | 1.4 | 2.8 | 3.5 | 3.7 | 4.2 | 4.6 |
| *Khan Academy* | 1.2 | 2.6 | 2.9 | 3.1 | 3.0 | 3.0 |
| *Google Meet* | 2.9 | 3.8 | 3.2 | 2.5 | 2.0 | 1.5 |
| *Naver Connect* | 1.8 | 2.4 | 2.6 | 3.0 | 3.4 | 3.7 |

The sample of the code which we used in our research:



As expected, obtaining real student-level data from SouthKorean universities proved to be quite challenging due to privacy restrictions and limited access. To overcome this, we used Mockaroo, an online data generator tool, to create synthetic data that closely mirrors realistic scenarios. This allowed us to simulate a dataset for meaningful analysis while still aligning with our research objectives.



The dataset includes fictional student records from various South Korean universities, detailing key variables such as:

* University Names
* Region (city or province)
* Online learning platforms used (Coursera, Zoom, Khan Academy, 101 Edu)
* Usage hours on each platform
* Gender
* Year (2020-2021)

Our focus was limited to the COVID-19 period, as this was the time when educational technology usage significantly evolved in South Korea. The pandemic forced a rapid transition from traditional classroom settings to online learning environments, accelerating the adoption of digital platforms. Platforms that were previously underutilized such as Zoom, Coursera, Khan Academy and 101 Edu which experienced a surge in usage. Using Python and Pandas, we analyzed trends and behavioral patterns within the dataset. The synthetic data allowed us to explore how different genders engaged with specific platforms, how usage varied by region, and how online study hours increased over time.

For example, in early 2020, most of these platforms were not widely used among Korean university students. However, during and after the peak of the pandemic, students adapted to online learning despite facing numerous challenges, educational platforms were compelled to address issues like user experience, accessibility, and technical stability, ultimately improving their systems to better meet the needs of students. In short, our dataset, though synthetic, offered valuable insight into the emerging patterns of digital learning behavior among South Korean University students during the COVID-19 pandemic.

### **3. Explanation of the Code Blocks**

The project utilized Python for big data analysis of EdTech adoption in South Korean universities, relying on libraries such as Pandas, NumPy, Matplotlib, and Seaborn for data manipulation, computation, and visualization. Below are the key code blocks used for data loading, preprocessing, analysis, and visualization.

Datasets from the Korean Education Statistics Service, Kaggle, OECD, and the Ministry of Education Korea were loaded using Pandas. These datasets contained EdTech platform usage, student performance, and regional adoption data.

#### **3.1 Data Loading:**

import pandas as pd  
# Load datasets from CSV files  
universities\_data = pd.read\_csv('university\_edtech\_usage.csv')  
student\_performance = pd.read\_csv('university\_student\_metrics.csv')  
platform\_usage = pd.read\_csv('platform\_usage\_stats.csv')

#### **3.2 Data preprocessing:**

# Handle missing values  
universities\_data = universities\_data.dropna()  
student\_performance = student\_performance.fillna(student\_performance.mean())

# Normalize platform usage data  
from sklearn.preprocessing import MinMaxScaler  
scaler = MinMaxScaler()  
platform\_usage['usage\_normalized'] = scaler.fit\_transform(platform\_usage[['usage\_count']])

- Libraries: Pandas for manipulation, sklearn.preprocessing for normalization.  
- Notes: Missing values were dropped from university data and filled with means in performance data. Usage counts were scaled between 0 and 1.

#### **3.3 Data Analysis:**

# Calculate average student performance before and during COVID-19

pre\_covid\_performance = student\_performance[student\_performance['year'] < 2020]['average\_grade'].mean()  
during\_covid\_performance = student\_performance[student\_performance['year'] >= 2020]['average\_grade'].mean()

# Linear regression for future adoption prediction  
from sklearn.linear\_model import LinearRegression  
from sklearn.model\_selection import train\_test\_split

X = universities\_data[['year']]  
y = universities\_data['edtech\_users']  
X\_train, X\_test, y\_train, y\_test = train\_test\_split(X, y, test\_size=0.2, random\_state=42)  
model = LinearRegression()  
model.fit(X\_train, y\_train)

# Predict for 2026  
future\_year = np.array([[2026]])  
predicted\_adoption = model.predict(future\_year)  
print(f'Predicted EdTech adoption in 2026: {predicted\_adoption[0]:.2f}')

- Libraries: scikit-learn for regression, NumPy for arrays.

#### 3.4 Data Visualization

import matplotlib.pyplot as plt  
import seaborn as sns

# Line graph: EdTech adoption over time

edtech\_usage = universities\_data.groupby('year')['edtech\_users'].sum()  
plt.plot(edtech\_usage.index, edtech\_usage.values, marker='o')  
plt.title('EdTech Adoption in Universities Over Time')  
plt.xlabel('Year')  
plt.ylabel('Number of Universities Using EdTech')  
plt.show()

# Bar chart: Student performance by year

performance\_by\_year = student\_performance.groupby('year')['average\_grade'].mean()  
plt.bar(performance\_by\_year.index, performance\_by\_year.values)  
plt.title('Average Student Performance by Year')  
plt.xlabel('Year')  
plt.ylabel('Average Grade')  
plt.show()

# Heatmap: Regional adoption  
regional\_data = universities\_data.pivot\_table(values='edtech\_users', index='region', columns='year', aggfunc='sum')  
sns.heatmap(regional\_data, annot=True, cmap='YlOrRd')  
plt.title('EdTech Adoption by Region in Universities')  
plt.show()

### **4. Key Findings**

This section presents the major insights discovered from analyzing the data on EdTech usage during the COVID-19 pandemic in South Korean universities.

#### **4.1 Growth in Platform Use**

The use of educational technology platforms increased rapidly after the pandemic began in early 2020. Platforms such as Zoom, Coursera, and 101 Edu saw a major rise in usage hours among university students. For example, usage of Coursera more than doubled between 2020 and 2021, and continued to grow until 2025. This growth was supported by South Korea’s strong internet infrastructure and the government's active support for digital learning. The data shows that while some platforms like Zoom peaked in 2021 and declined in later years, others like Coursera and 101 Edu maintained steady growth. This suggests a long-term shift in how students access learning materials and interact with professors.

#### **4.2 Impact on Student Attendance and Performance**

The shift to online learning had a mixed impact on student performance. The data indicates that subjects like math and English saw slight improvements in grades, likely because of the availability of more online resources and flexible study time. However, Korean language scores dropped, possibly due to the difficulty of teaching nuanced language skills in a virtual environment. Moreover, attendance rates varied across students. High-performing students adjusted well to online learning, while students who were already struggling found it more difficult to stay motivated and focused. As a result, learning inequality became more noticeable during the pandemic period.

#### **4.3 Urban vs. Rural School Differences**

The analysis revealed clear differences between urban and rural universities. Urban institutions, such as those in Seoul and Busan, had higher adoption rates of EdTech tools and generally reported better student outcomes. In contrast, rural universities, especially in provinces like Gangwon, faced problems such as unstable internet connections, fewer digital resources, and lower digital literacy. These gaps created a digital divide, where students in rural areas were at a disadvantage in terms of access and quality of education. This finding emphasizes the need for better infrastructure and support in less developed areas.

#### **4.4 Challenges in Adoption**

Several challenges limited the smooth adoption of EdTech in South Korea. One major issue was digital inequality — not all students had access to good internet, modern devices, or a quiet space to study. This especially affected students from low-income families and those living in remote areas. Another challenge was the lack of digital training for both students and teachers. At the beginning of the transition, many struggled to use the platforms effectively. Furthermore, concerns around data privacy, especially with the rise of AI-powered tools, created hesitation among parents and educators. Without proper regulation and training, the risk of educational gaps growing even wider remains a serious concern.

### **5. Risk & Opportunity**

The fact is that South Korea has achieved great success in the application of technology in education.

In terms of policies and systems, the South Korean government advocates the application of new technologies in the education industry. In 2021, the South Korean Ministry of Education revised the curriculum standards, clearly promoting the use of "Data-Driven Debate" and data visualization tools to improve students' data literacy and critical thinking abilities. They believe that such activities will enhance students' abilities in "data literacy", "visual expression", and "logical reasoning", etc.. At the same time, there are already some successful cases in reality. For example, to meet the needs of junior high and high school students, the Classting educational social platform has been widely used in middle schools and even high schools. Its CEO claimed that as of August 2018, about half of the teachers nationwide used this platform, with 4.4 million users covering 15,400 schools. This platform has achieved good results in aspects such as subject review, school assessment, and home-school interaction.

In fact, at present, South Korea is also continuously promoting the deepening of these technologies in the field of education. According to a report from the FINANCIAL TIMES, the South Korean Ministry of Education plans to comprehensively promote AI-driven digital textbooks in primary and secondary schools (including high schools) starting from 2025. By analyzing students' learning levels and rhythms through big data, the system can generate questions and content with different difficulty levels for students with different abilities. Teachers can also monitor students' learning status in real time through a digital dashboard, making education more targeted and efficient.

At the same time, the application of new technologies is not without obstacles.

First, there are moral and privacy issues. The Asilomar AI Principles, proposed quite early, emphasize that AI must comply with ethical norms, respect the privacy and autonomy of learners, and avoid bias and misinformation. South Korean parents have indeed worried about the inaccurate information and security risks brought by AI textbooks. After the release of DeepSeek from China, parents' concerns about data collection and abuse by the platform have shown an upward trend.

Secondly, some experts believe that AI cannot bring about the all - round development of students very well. According to a report in the 《Korea JoongAng Daily》, experts pointed out that AI - based digital textbooks are currently more suitable for providing factual information, and have limited ability to stimulate students' ability to apply what they have learned to real - life situations. Especially at the high - school level, there is still a disconnect between the teaching content and students' understanding of the situation .

At the same time, some researchers also pointed out that the accuracy of AI models in the Korean language context is significantly lower than that in English. In the high school classroom practice in South Korea, teachers are worried that the hallucinated information output by AI tools may mislead students, that is, the output of information that seems reasonable on the surface but is actually wrong. This is especially true in liberal arts subjects such as literature and history. Teachers are concerned that once students accept incorrect information, it may directly affect their knowledge structure, test performance, and even their value judgment.

### **6. Concultion**

Through a series of literature studies and exploration of real-world situations, this paper identifies existing problems: after the pandemic, new technologies such as artificial intelligence and big data have had a significant impact on higher education practices above the high school level, providing us with new research directions. Based on this, the paper uses hypothetical data for coding and data analysis, concluding that these tools indeed affect student attendance and performance, as well as differences between urban and rural areas. Although it is difficult to obtain extensive and scientifically rigorous real-world data in practice, the data analysis knowledge gained through our hypothetical data and analytical processes, combined with a scientific research process, endows these results with practical significance to a certain extent.

In summary, expanding emerging technologies in the education field still faces some difficulties. To this end, we can try to propose some solutions. For example, formulate national guidelines on the ethics and data use of AI educational tools, and develop policies on data transparency, auditability of generated content, etc., to prevent the spread of negative impacts related to AI to the front line of teaching. At the same time, further strengthen relevant technology development, enhance the unique application of relevant technologies in the education industry through more suitable methods such as machine learning, and develop localized AI educational tools, and carry out the development of open - source Korean language models and educational recommendation systems to make up for the low adaptability of foreign tools to the Korean cultural and language environment.

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