



# College Students' Innovation and Entrepreneurship Capacity Construction in the Era of Meteorological Big Data

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## Abstract

College students are one of the groups with the greatest potential for innovation and entrepreneurship. To carry out innovation and entrepreneurship education in colleges and universities and actively encourage college students to start their own businesses is a major strategic measure for the education system to deeply study and practice the scientific Outlook on development and serve the construction of an innovative country. It is also an important way to deepen the teaching reform of higher education and cultivate students' innovative spirit and practical ability. It is also a way to implement the practice of promoting employment through entrepreneurship. An important measure to promote the full employment of college graduates. As an important part of the national innovation system, colleges and universities shoulder the mission of cultivating talents with innovative ability under the new situation. Based on the interdisciplinary, practical and situational characteristics of big data and Internet+, and combined with the theoretical knowledge and practical experience of "Innovation, Invention and Intellectual Property Practice" and "Foundation of Innovation and Entrepreneurship Education", this paper aims to provide meteorological big data service for college students' innovation and entrepreneurship projects. Research and practice on the training of college students' innovation and entrepreneurship ability based on meteorological big data will be carried out, and a diversified and three-dimensional training model oriented by meteorological service will be established eventually. It will help students improve their ability of innovation and entrepreneurship in the context of meteorological big data. Through guiding students to participate in innovation and entrepreneurship projects, students can gradually improve their interest in learning, strengthen their innovation and entrepreneurship ability, and cultivate high-level innovative and entrepreneurial talents to meet the needs of the construction of an innovative country.

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## Subject Areas

Atmospheric Sciences

## Keywords

Innovation and Entrepreneurship Education, Meteorological Big Data, Internet+ Era, Undergraduate

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## 1. Introduction

On September 5, 2015, the Notice of The State Council on Printing and Distributing the Action Program to Promote the Development of Big Data was officially released, causing extensive influence in the whole society [1]. Meteorological big data is a comprehensive term for various existing meteorological data. Through studying and analyzing the changing rules of industry events, appropriate predictions can be made for future events [2]. Meteorological big data, a member of the big data family of government affairs, belongs to natural information data [3]. The amount of meteorological data is increasingly large. The current total amount of data is about 23PB, and the daily data stream is dozens of terabytes. In the era of “Internet plus”, the potential of meteorological services seems to be taken seriously by more and more industries [4]. The China Meteorological Services Association estimates that the market size of meteorological services will reach 300 billion yuan by 2025 [5]. In December 2017, the China Meteorological Administration released the Action Plan for Meteorological Big Data (2017-2020), committed to building the meteorological big data Cloud platform into the most complete and authoritative online data warehouse and data mining application platform of meteorological departments [6]. Meteorology is not only about providing weather forecast, telling people what clothes to wear tomorrow and whether it is suitable for travel. The meteorological industry will also usher in the era of “weather+”. Meteorological big data is widely used and can shine in many industries such as agriculture, tourism, transportation, insurance and business [7] [8] [9]. It is particularly important to explore the potential value of meteorological big data in innovation and entrepreneurship.

College students are one of the groups with the greatest potential for innovation and entrepreneurship. To carry out innovation and entrepreneurship education in colleges and universities and actively encourage college students to start their own businesses is a major strategic measure for the education system to deeply study and practice the scientific Outlook on development and serve the construction of an innovative country. It is also an important way to deepen the teaching reform of higher education and cultivate students’ innovative spirit and practical ability [10]. It is also a way to implement the practice of promoting employment through entrepreneurship. An important measure to promote the full employment of college graduates. As an important part of the national in-

novation system, colleges and universities shoulder the mission of cultivating talents with innovative ability under the new situation [11].

In recent years, the employment consciousness of college students majoring in meteorology has changed obviously, but most students' employment thought is still passive. With the rapid development of meteorology, the number of college students majoring in meteorology is increasing year by year. Therefore, the traditional employment consciousness can not adapt to the development of The Times. Therefore, in the era of "meteorological big data" and "Internet Plus", it is necessary to reform and innovate the courses of innovation and entrepreneurship for college students majoring in meteorology [12] [13]. In addition to the emphasis on the explanation of basic theoretical knowledge of atmospheric science, it is more important to strengthen the cultivation of meteorological talents' innovation and entrepreneurship ability, and use meteorological knowledge to cultivate their spirit and consciousness of "seeking a career and creating a career". While cultivating the innovation and entrepreneurship ability of meteorological science and technology talents, we should also pay attention to improving their market competitiveness. This requires us to train them from knowledge, ability, quality and other aspects to make them suitable for modern industry and internationally competitive "mass entrepreneurship" talents.

This paper focuses on connecting college students' innovation and entrepreneurship projects with the meteorological industry, so that students can understand the current situation of the meteorological industry, meteorological big data mining, meteorological employment under the situation of the Internet, meteorological data development and analysis. The students have a full understanding of the value of big data, the application of big data meteorological service model, the development characteristics of meteorological service technology, and the innovation of big data meteorological service model. This paper improves students' interest and love of this major, and enables them to have broader employment channels and entrepreneurial ideas according to the characteristics of the meteorological industry after graduation, which is the innovation and novelty of this paper.

## **2. Development Status of the Meteorological Industry in the Era of Internet+ and Meteorological Big Data**

In the meteorological industry, a variety of meteorological data is usually referred to as meteorological big data. By analyzing the changes of meteorological big data, meteorological staff can summarize the changing rules of meteorological events, and then make predictions for future climate phenomena [14]. Forecasting in the weather service industry also needs to be combined with other cross-industry data. The data in other fields are integrated with that in the meteorological field to compose the heterosexual data. The big data method is used to study and analyze the heterosexual data, so as to speculate the future development of meteorology [15] [16]. In the field of meteorology, a big data chain is

formed by integrating the work data of various departments, namely, big data of meteorology. “Big data of industry” and “big data of Internet” are two important components of big data of meteorology. The connotation of meteorological big data mainly includes the following aspects: meteorological data detected by the most authoritative and scientific meteorological observation system in our country. All kinds of data generated by Chinese meteorological departments and systems are used in meteorological services. Data generated and managed by the meteorological project management department.

On May 27, 2014, China Meteorological Administration and Internet giant Alibaba Group established cloud platform strategic cooperation to jointly explore the deep value of meteorological data, officially opening the door of big data application [17]. In November 2014, the Sixth National Conference on Meteorological Services proposed that meteorological institutions and enterprises should play a leading role in technological innovation [18]. We will promote innovation in key technologies such as the application of numerical models of meteorological services with high spatio-temporal resolution, impact-based meteorological forecasting and early warning, and in new technologies and means such as big data, the Internet of Things, cloud computing and new media.” At this point, the concepts of “big data, Internet of Things, cloud computing, Internet plus” and other epochal significance have been promoted to the level of meteorological data service application. Meteorological service is no longer just about the application of basic data such as weather forecast, but the deep mining and application analysis of meteorological big data by using big data thinking and Internet platform, so as to achieve new value breakthroughs in meteorological data.

In foreign countries, Ford Motor Company uses meteorological big data to build a meteorological factory in Germany. By simulating the weather, it can test the safety, durability, comfort, brakes, air conditioning and so on of cars. It can even simulate the snow and altitude of Mount Qomolangma to test the performance of cars in extreme temperatures. Weather Channel Co., LTD cooperated with Walmart to find out the relationship between weather and commodity sales through the analysis and research of meteorological data combined with sales data, order information and other data, so as to help Walmart increase commodity sales. “Ele. me”, a well-known Chinese food delivery company, once lost millions of distribution resources due to a heavy rain in Beijing, which made people realize the importance of professional meteorological services for the first time. However, as early as 2006, a foreign climate company provided crop insurance to farmers by combining meteorological data with weather simulation, plant structure and soil analysis. DHL, the world’s biggest Courier company, uses weather data to help its global deliveries. SEARS keeps a good supply of essential items by keeping track of the country’s weather. Customized meteorological services have a huge market space. According to the joint statistics of China Meteorological Administration and National Bureau of Statistics, the value of customized meteorological services in China currently exceeds 200 billion

yuan. Meteorological data is a factor that almost every industry needs to pay attention to. Agriculture is not the only industry that “depends on the weather”. By understanding the weather conditions in advance, amusement parks can predict the flow of people, reasonably arrange activities and performances, arrange staff schedules and equipment maintenance; through customized meteorological service, the food delivery industry can reasonably plan the delivery route, effectively shorten the delivery time, improve the on-time rate, and dynamically adjust the logistics capacity, thus reducing the loss caused by weather factors. Identifying the combination of various industries and big data to create customized meteorological services will create huge value.

### **3. Opportunities and Challenges in the Era of Internet and Meteorological Big Data for Atmospheric Science Professionals**

Driven by the country’s new infrastructure and platforms, data sharing across industries has become a trend. Greater openness and sharing of meteorological data is in line with the trend. In this context, the role and importance of meteorological data centers will be increasingly enhanced. Supporting AI algorithm will become a compulsory course of meteorological data center. AI is playing an increasingly significant role in the information industry, exerting a comprehensive influence on observation data, weather forecasting, climate forecasting, public services, industrial services and early warning issuance. The meteorological data center needs to provide AI-related data samples, algorithm research, product processing and other whole process support.

In the future, cooperation between the meteorological industry and AI enterprises is inevitable. Meteorological service enterprises with unique characteristics and AI technology support will become an important part of meteorological service.

On the other hand, the future meteorological data center is no longer a simple data storage and provider, but also needs to provide computing resources and platform support for meteorological algorithm model and product innovation, and provide support for social innovation and mass intelligence innovation technology and products.

Due to the predictable surge trend of data volume, the use of national and provincial data distributed storage and calculation has become a feasible solution for meteorological data center. National cloud computing combined with provincial and municipal edge computing will be a feasible operation mode. Under the trend of people’s video-oriented life, how to efficiently collect, store, process and process video images has become an inevitable problem for meteorological data centers due to the large storage space occupied by video. Meteorological data centers need to consider the linkage and cooperation with national data centers and data centers of other industries to build and co-exist under the guidance of the national new infrastructure strategy.

In the future, there are four main forms of meteorological services: basic me-

teorological services with large data volume and high concurrent processing; weather, impact and risk meteorological services based on location, user and scene; meteorological services of high impact and high impact events; and immersive interactive meteorological services.

In the coming 5G era, weather services need to find a new entry and form. At present, urban smart governance and data sharing and integration have created a strong demand for refined smart meteorological services, forcing meteorological departments to provide AI-based intelligent, automated and personalized meteorological services, making it possible to issue targeted warnings, impact forecasts and risk warnings. Advances in autonomous driving and the Internet of vehicles will lead to round-the-clock, road-specific weather services.

Under the impact of new information technology, traditional film and television weather service business is facing the challenge of transformation and upgrading. Cameras, drones, iot sensing facilities, 5G and other technologies will change the way of media material collection, artificial intelligence and other new technologies will change the way of media material processing, traditional TV and channel mainstream media channels will be overturned.

Stimulated by the sharing of basic meteorological data and the demand for professional meteorological services in the industry, the number of meteorological service enterprises will grow rapidly. Powerful international meteorological service companies will gradually enter the market, and meteorological service enterprises and institutions with AI technology support and distinctive meteorological service solutions will grow rapidly. Relying on the meteorological service platform and ecology, it will be a feasible way to improve the modernization level of meteorological services to produce customized meteorological service solutions for unique needs.

#### **4. Innovation and Entrepreneurship Education and Training for Meteorology Specialty**

At present, the meteorological department is still short of relevant professional talents and teams in the application of meteorological big data. Meanwhile, the application of meteorological big data in innovation and entrepreneurship education in colleges and universities is still relatively lacking. Researchers believe that with the increasing perfection of data analysis and data mining technology, data has unprecedented vitality and vitality, breeding the application and innovation of new methods, which is conducive to improving the education mode of innovation and entrepreneurship in colleges and universities from the aspects of education mode and education concept, and constantly improving the quality of talents. Compared with traditional innovation and entrepreneurship education, the ideas and methods of meteorological big data will bring many advantages to innovation and entrepreneurship education. In terms of course learning, by enriching the data sources of course materials, meteorological big data can innovate the mode of classroom learning, expand the thinking of innovation and entrepreneurship decision makers, and improve their response ability. In terms

of practical training, meteorological big data technology can establish a rich database of innovation and entrepreneurship, cultivate the ability of innovation and entrepreneurship subjects to make decision plans through case analysis, and improve the education system of innovation and entrepreneurship. Therefore, they believe that big data can drive the reform of innovation and entrepreneurship education in universities, effectively improve the scientific nature of innovation and entrepreneurship education, and further stimulate the development potential of innovation and entrepreneurship education. Some researcher believes that the application of big data in higher education can overcome the drawbacks of traditional education, such as rigid thinking, fragmented resource data and lack of data application talents, and is conducive to improving the system and mechanism construction of innovation and entrepreneurship education, accelerating talent training and meeting social needs [19] [20].

In conclusion, the application of meteorological big data as a subset of big data to promote innovation and entrepreneurship reform in colleges and universities is conducive to the construction of an innovation and entrepreneurship education system integrating classroom teaching, independent learning and social practice, which can meet the learning needs of different students, improve their innovation and entrepreneurship ability, and thus improve the quality of innovation and entrepreneurship education [21].

#### **4.1. The First Stage, Guidance of Innovation and Entrepreneurship Competition for College Students Majoring in Meteorology**

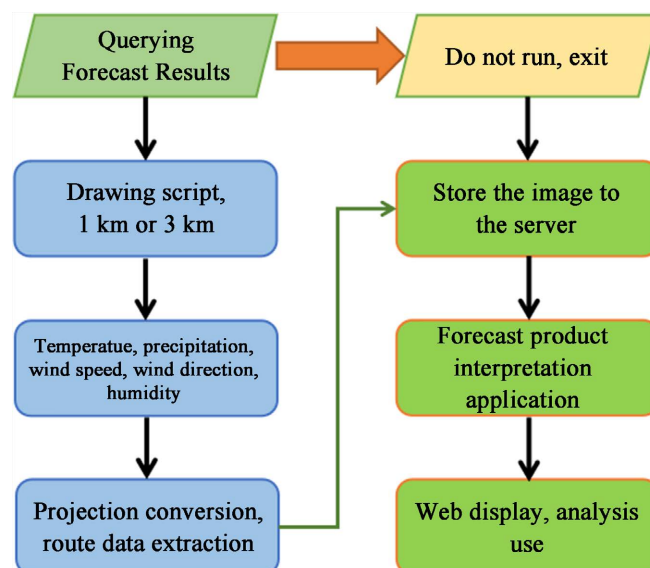
In this stage, the main training and improvement of students' personal ability, training to actively participate in various college students' innovation and entrepreneurship competition projects. Innovation and entrepreneurship have increasingly high requirements for the personal quality of college students. College students should grasp the knowledge of various fields, establish correct values and outlook on life, correct entrepreneurial attitude, and adhere to the legal and moral bottom line in the process of entrepreneurship on the basis of full understanding of meteorological big data. Only by enhancing their own quality and correct entrepreneurial attitude can entrepreneurs lay a good foundation for entrepreneurship and improve the success rate of innovation and entrepreneurship. At the same time, innovation and entrepreneurship competition is an important carrier for universities to cultivate and inspect college students' innovation and entrepreneurship ability. Relying on the competition, students' ability, ideas, paths and innovation points of using meteorological big data for innovation and entrepreneurship can be mainly examined, which is conducive to students' showing their own strength, colleges and universities exploring new paths for innovation and entrepreneurship education, and improving students' information level and innovation and entrepreneurship ability.

The following describes the projects based on "meteorological big data" to guide college students to participate in the innovation and entrepreneurship competition. Through meteorological big data and information services, some

dangers will be timely informed to people in advance, reminding people to take precautions in advance, reduce risks, and reflect the quality service of meteorological big data.

**Case 1: “Navigation-free” UAV intelligent weather detection system is designed to develop apps, small programs and websites about meteorological big data applications.** Automatic access and download of complete raw data from National Weather Service or local weather stations to local databases every hour. Then, the original observation data were counted through the characteristics of different meteorological elements, and the impact of starting and ending points, routes and weather conditions on UAV flight was combined to establish the APP of “No worries on navigation” UAV intelligent weather monitoring system. During the flight of UAV, corresponding flight suggestions are put forward to enable users to take early warning measures to avoid unnecessary losses and facilitate the flight of civilian UAV (**Figure 1**).

**Case 2: The project of “Road Traffic Grid Meteorological Information Service and Forecast Product of Southwest China”,** which is aimed at the road traffic network of Southwest China and forecasts the meteorological elements of the traffic road condition information of Southwest China, mainly including the weather elements that have a great impact on traffic safety, such as fog, precipitation, high temperature and road icing. Before the trip, users can locate the specific route and input the start and end point of the trip on the APP. The APP will access the encrypted automatic weather station monitoring and warning system and numerical model processing system, and combine real-time forecast, satellite data, automatic weather station data and local radar data. According to the user’s driving route, the weather conditions on the driving route and the time of the impending catastrophic weather on the driving route will make early warning reference. Users can easily get the traffic information and weather warning



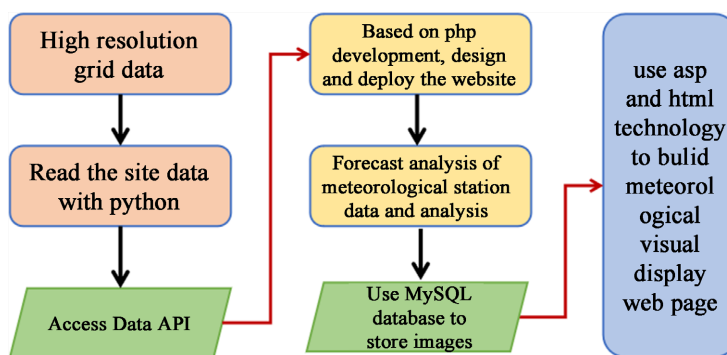
**Figure 1.** Operation flow chart of the intelligent weather detection system for unmanned aerial vehicle.



information of the whole road traffic network, so as to judge whether the area can pass safely, so as to reduce the occurrence of traffic accidents and make meteorological big data information play a greater role. The project not only completed the weather warning function, but also developed the community function, so that users can communicate with others when using the product, and obtain better experience. Develop small program and life number and other use methods, to bring great convenience to users; introduce merchants to settle in, mutual benefit and win-win. The product has a professional early warning system and mature marketing program, aiming to give users the best weather early warning service.

**Case 3: “Analysis and Display of 3D Visualization Meteorological Data and Extended Application**, which based on high-resolution data assimilation model data” project is based on the application, advantages and disadvantages of meteorological data visualization and the possibility of optimization research, and on this basis, the real-time weather analysis system of traffic network considering the influence of weather. The project uses cloud server to build meteorological data database, analyzes grid meteorological data on back-end virtual cloud host, and uses asp and html technology to build visualization three-dimensional meteorological data system website at the front end, which displays the national temperature, precipitation, wind speed and direction flow field, air pressure, relative humidity and other real conditions on the website server in real time. And access to Gaofen weather data API, show the national urban weather forecast results. Eventually, users can make weather forecasts on the site according to their needs, such as highway conditions and real-time weather. In this way, students break the traditional thinking of employment and entrepreneurship, and increase their chances of employment and entrepreneurship in the future by crossing fields (Figure 2).

Through the above college student innovation and entrepreneurship competition projects, strengthen the coordination mechanism and strengthen the top-level design, and effectively improve the innovation and entrepreneurship ability of college students. Teachers should understand relevant policies, contact and support the local government, relevant enterprises and meteorological departments, and provide financial guarantee for college students’ innovation and



**Figure 2.** Flow chart of 3D visualization meteorological data analysis and display system.

entrepreneurship, so that students can devote themselves to innovation and entrepreneurship. It is also necessary to constantly adjust innovation and entrepreneurship courses in light of social development, and cultivate innovative and entrepreneurial thinking of college students from multiple perspectives. To provide more practical opportunities for students, strengthen cooperation with off-campus enterprises engaged in meteorological service, so that students can fully understand innovation and entrepreneurship, go out of school, understand social needs, explore the combination of various majors and meteorological big data, and create new technology or service mode. Teachers make full use of the advantages of meteorological big data, and guide college students to make full use of Internet technology and meteorological big data in innovation and entrepreneurship, and actively change the traditional entrepreneurial mode. Teachers must actively cultivate students' innovative thinking, encourage them to participate in activities such as innovation ability competition and social practice, stimulate students' awareness of innovation and entrepreneurship, fully tap students' potential, so that students can find favorable business opportunities in the fierce social competition and improve the success rate of entrepreneurship.

#### **4.2. The Second Stage, To Optimize the Course System, Broaden the Scope of Entrepreneurship and Increase Entrepreneurial Opportunities**

At present, the content of innovation and entrepreneurship guidance course is relatively simple, which is difficult to stimulate students' learning enthusiasm. For example, the current innovation and entrepreneurship courses only introduce the connotation and dialectical relationship of innovation and entrepreneurship, as well as the meaning, purpose and type of innovation, and elaborate the connotation of economic innovation, scientific and technological innovation, social innovation and cultural innovation from a macro perspective. Lack of connection with the major of atmospheric science, for example, how to integrate meteorological big data and meteorological information analysis into the course of innovation and entrepreneurship is a complicated process. Teachers should organize innovation and entrepreneurship practice activities, combined with the social reality, to fully mobilize students' learning enthusiasm. The curriculum arrangement can be appropriately increased to increase the degree of emphasis on innovation and entrepreneurship courses, and the social situation and students' entrepreneurship can be fully integrated. At present, meteorological big data is mainly applied in the tertiary industry. New theoretical and practical courses should be explored. Courses and teaching practices should be actively approached to meteorological big data. Nowadays, information technology is becoming more and more popular, and meteorological data is increasing day by day. At present, college students' innovative and entrepreneurial thinking should be further optimized to develop in the direction of humanization and science and technology, so as to truly improve their entrepreneurial practice ability. By using the methods and technologies of meteorological big data, col-

lege students can carry out relevant work at any time after they have made clear their entrepreneurial direction in the meteorological field. To enable them to understand the diversified entrepreneurial channels, rich entrepreneurial resources and convenient operation mode in the meteorological field is very beneficial to improve the success rate of entrepreneurship of college students.

In a word, meteorological big data has brought new development opportunities and challenges for the talent training of colleges and universities, and promoted the innovation and reform of the teaching system and talent training of colleges and universities, so as to meet the needs of the social market, facilitate students to better adapt to the changes of The Times, and lay a good foundation for future employment and entrepreneurship.

### **5. Application Promotion Value**

In the era of meteorological big data and Internet, we need to change the educational concept of talent training at the present stage, and strengthen the cultivation of practical ability of innovation and entrepreneurship while focusing on theoretical knowledge education. Through the innovation and reform of “Internet+ meteorological big data” mode, innovation and entrepreneurship education is effectively incorporated into the professional education and cultural quality education system, and the focus of engineering talent training is shifted to the cultivation of innovation and entrepreneurship ability. Highlight the specialty characteristics, integrate the content of the specialty course with the practical application of innovation and entrepreneurship, and actively promote the effective connection of the practical teaching of innovation and entrepreneurship. This can provide reference value for the following similar courses.

### **6. Conclusion**

This study allows students to understand the current situation of meteorological industry, meteorological big data mining, meteorological employment under the situation of the Internet, meteorological innovation cases, meteorological data development environment, meteorological data analysis and use, and the development status of domestic and foreign meteorological companies. The students have a full understanding of the value of big data, the application of big data meteorological service model, the development characteristics of meteorological service technology under the background of big data, and the innovation of big data meteorological service model. It improves students’ interest and love of this major, and enables them to have a wider range of employment channels and entrepreneurial ideas according to the characteristics of the meteorological industry after graduation. Through this project, a bridge will be built between “Internet+ big data” and meteorological application, meteorological service and transformation of meteorological scientific and technological achievements, so as to realize the value of innovation and entrepreneurship in the meteorological industry and create more wealth for the society.

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## Conflicts of Interest

The author declares no conflicts of interest.

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