A Study on the Utilization of Drone Education in the Fourth Industrial Revolution

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Abstract. In the era of the Fourth Industrial Revolution, various high-tech technologies are developed. Among these technologies, drone field is currently very burgeoning and important. Especially when drones become cheaper, drone technology gets more popular. Therefore, research on the methodology of drone education is very necessary. And in future societies, the demand for creative talent increases. However, there is a lack of relevant research compared to the importance of drone education. So this study is about the methodology of drone education that is practically available in educational institutions. The results of this study can enhance learners’ understanding of drones and the opportunity to use drones in various fields. In addition, the learners will be able to improve their problem-solving skills and creativity. And these findings can be used in future drone projects. In addition, the result of the study can be a theoretical basis for future education.

1. Introduction

1.1. Research Background and Purpose
In the era of the 4th Industrial Revolution, governments invest a lot in drone fields. And as many people use smart-phones, the spread of personal drones is expanding. A large amount of universities and businesses try to develop technologies in drone field. China’s DJI is a representative drone-related company. These companies grow into unicorn companies with the trend of time. Education would also change with this trend of time. Convergence talent education is especially important as there is great need for creativity and innovation. Developed countries combine computer program education to create a variety of curriculums. With the advancement of computer technology, the demand for computer software developers is increasing. Computer technology is also utilized in all areas. So drone education should be developed in combination with computers. However, it is still difficult to apply the drone training course to educational institutions. Therefore, this study researched practical drone curriculum and utilization. The results of this study can be useful data for drone business. It can also be used as a theoretical material for future creative education.

1.2. Literature Review
In the era of the Fourth Industrial Revolution, drone technology is recognized as a very important technology for future transportation systems. For this reason, many people are interested in drone technology. So education on drones is being developed. First of all, research related to drone education were as follows. Kim Ki Hyuk et al. (2016) studied the education for how to bring the aging
population to the drone industry [1]. Park Min Ah et al. (2019) studied a method of training basic drone flight skills and analyzed various existing drone training contents [2]. Chun, Bo Ae (2018) presented direction and model of career education associated with geography subject in the free-semester education system [3]. Yoon Gyeong Ran et al. (2017) considered how elementary school students’ interest in mathematics and STEAM literacy could be promoted by conjoining the learning of mathematics with the learning of drone topics [4]. Park Jeon (2019) tried to know how to develop and apply the lessons of 6th grade elementary school biology and environmental unit using drones, satisfaction with application of biology and environmental unit class using drones, and how to affect students' STEAM attitudes through class of biology and environmental unit using drones [5]. Kim Eung Kon (2018) proposed a block program using a drone [6]. Kim Eung Kon (2018) also developed a three-dimensional movement of the underwater drones using Scratch program to facilitate the basic structure and programming of the computer’s basic structure and programming [7]. Jung Hyung hoon et al. (2019) analyzed the safety perception of the pilots based on the DREEM (Dundee ready environmental assessment) model designed to evaluate the educational environment along with the current state of drone education in Korea [8]. Most of the research results were practically difficult to use in educational institutions. Also, people who were not familiar with drones had to starting learning based on difficult theories. In the light of these, research on drone education applicable to educational institutions is urgently needed. This study, therefore, aimed to present future education methods using drones. These findings can be used as basic data for drone education.

2. Research Method

Drone industry is developing very quickly in the era of the Fourth Industrial Revolution. And many people are interested in drone education. Despite these circumstances, there is much lack of research on the methodology of drone education. So this paper studied the teaching method using drones. First of all, this study carried out a study on the theory of drones. It also carried out theoretical research on drone education. These theoretical studies were based on the study of literature. Therefore, reference materials used books, papers, newspaper materials, etc. This study analyzed the contents and curriculum of drone training by visiting educational institutions. Afterwards, drone training courses were developed for educational institutions in this study. These courses may present the methodology of future education in the era of the Fourth Industrial Revolution.

3. A Theoretical Study

3.1. Drone

Drone is a flying object that moved by remote control (figure 1). Drones can be used in a variety of areas. The early drones were mainly developed for military use. However, as multinational companies such as Google and Amazon developed drones, many people are interested in personal drones. So now drones are widely used in aerial photography. They are also used for agriculture and freight transport. Currently, commercial drone markets are growing rapidly, and advanced countries such as the U.S. are investing in large-scale research and development.

Figure 1. Drone [6]
However, there is very little expert who can use drones. Therefore, research is needed on educational programs and methodologies that can teach how to use these drones. A representative educational program is video editing through drone filming. These drones have remote control and self-regulation. Drones are different from conventional RC products that only remotely adjust. They can run on their own according to programs organized through coding. The principle of flight of a drone is that four propellers are generally rotated. As the propeller rotates, the wind blows down and the drone floats in the air.

3.2. Drone Education
Drone education has developed educational programs that can combine hardware and software (figure 2). Typical drone education can be divided into four categories. The first representative drone education is drone operation method and control technology. And the second representative drone education is the filming technology of drones. The third representative drone education is drone video editing technology. The fourth representative drone education is computer software and drone manufacturing technology. Drones can be divided into small, medium, and large ones depending on their size. It is about 15cm in small size, 30cm in medium size, and more than 50cm in large size. For educational purposes, small and medium sizes are generally used. And the demand for drone education has increased recently as individuals have become more interested in drones (figure 3).

![Figure 2. Drone Education](https://example.com/figure2.png)

**Figure 2.** Drone Education [3]

![Typical Drone Education](https://example.com/typical.png)

**Typical Drone Education**

- Drone operation method and control technology
- Filming technology of drones
- Drone video editing technology
- Computer software and drone manufacturing technology

![Figure 3. Typical Drone Education](https://example.com/figure3.png)

**Figure 3.** Typical Drone Education

4. Problems of Drone Education
Some advanced countries such as the U.S. are providing drone training at private educational institutions. However, the problem is that it is expensive for all students to use drones. With the recent popularization of small drones, many people are interested. However, even small drones are still
expensive. So it is difficult to educate using drones in developing countries. Moreover, there is a risk of accidents in the use of drones by learners. And computer programs used in drones are difficult to learn. Because of these difficulties, students can easily lose interest in computer programs using drones. So it is necessary to develop an appropriate drone training course to solve these problems (figure 4).

**Figure 4. Problems of Drone Education [3]**

5. Methods of Drone Education

5.1. Drone Operation Education
The most basic part of drone education is drone operation education. Depending on the purpose of the drone's filming or transportation, drone control methods are different. The basic elements of drone operation education are as follows. The first is hovering. Hovering is a technology that keeps drones from moving at constant altitudes. The second is the throttle. Throttle is a technology in which a drone rises vertically as the propeller rotates rapidly. The third is yaw. Yaw is when a drone rotates left and right. The fourth is pitch. Pitch refers to the angle at which a drone leans to move forward. The fifth is roll. Roll refers to the rapid movement of a motor on one side to tilt from side to side. Besides these technologies, there are also various methods of drone operation (figure 5).

**Figure 5. Radio Communication System of Drone [7]**

5.2. Computer Software and Drone Education
Talent required by the future society is those who can solve problems through computers. Computer thinking ability is very important in future education. And coding education using computer software is also important in drone education. Drone is an important technology in the era of the Fourth Industrial Revolution. Drone education increases educational value when combined with computer program education. Students can use scratches for easy-to-access computer programs, and use scratches to manipulate drones. Scratch is a block-type coding program and has features that children can learn easily. The drone's command through the block format can be made in real time. And drones
are operated by computers by connecting the wireless communication system with USB. Wireless communication systems are linked with scratch programs to communicate in real time (figure 6).

![Image of drone components]

**Figure 6.** Radio Communication System of Drone [7]

5.3. Drone Education Course

Specific drone education courses are as follows. The first course is that teacher gives students theoretical education on drones. Classes related to the principles, characteristics, and methods of use of drones are conducted. And teacher uses drones to introduce students to new jobs that will emerge in the future. These courses can raise students' interest in drones. The second course is teacher teach students how to control drones. Students run their own drones. And students observe the movements of drones. Through these observations, students can calculate the speed of a drone. In the process of finding speed, students can understand math and physics. In particular, drones can be used in future geography. So teachers can use drones to teach students how to take aerial photographs and make maps. The third course teaches students the design of the form of the drone. This is a process in which students understand the shape of a drone. Through this process, students can design their own shapes of drones. Students can draw designs through the principle of linear symmetry. And through these designs, students make their own drone models. The fourth course is for teacher to discuss the problems caused by the development of drones. Students can develop critical thinking through these discussion courses. In addition, teacher can teach students how to debate in these discussion courses. In these courses, students can find and present materials about drones. Through these presentations, students can learn about drones. This method of education does not simply learn knowledge, but increases convergence thinking (figure 7).

![Image of drone education course diagram]

**Figure 7.** Drone Education Course
6. Development Direction of Drone Education

Until now, drone education has mainly been developed in terms of technology. However, future drone education will be developed in combination with convergence education programs. For example, students need an education program that connects math and English subjects with drones. In the future, humans have still to face various problems such as climate change, energy problems, and environmental pollution, etc. So the ability to solve these problems based on various knowledge and skills is important. Students can improve their problem-solving skills and creativity through drones. Also, students are able to understand the world that will change through this education and their future jobs on drones. And education based on cutting-edge technologies such as drones and robots varies greatly depending on region and country. Therefore, in the future, various education technologies for the Fourth Industrial Revolution will be needed in developing areas such as Africa by utilizing various information technologies.

7. Conclusion

In the era of the Fourth Industrial Revolution, the rate of change in all industries is very fast. Education should also reform with these changes. In particular, future society will see an increase in drone technology. So in the future, drone-based education will become common. Therefore, this study suggested a drone education method that can be used by educational institutions. The drone education methods presented in this paper were as follows. The first was theoretical education on drones. The second was education on drone control. The third was design education on the form of drones. The fourth was to discuss the problems caused by the development of drones. In the future, various courses using drones will have to be developed. And learners should develop their ability to solve various problems through drones. Therefore, drone education should be a curriculum where advanced science and technology can be a means, not a purpose.

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