

A Preliminary Discussion on STEM-Drone Sport's Athlete Development Program toward Career Relevance

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Received 15 May 2023, Received in revised form 26 July 2023
 Accepted 30 September 2023, Available online 30 December 2023

ABSTRACT

This article aims to explore the potential for STEM education and athlete development programs to enhance career relevance in drone sports. This article provides an overview of the significance of STEM education in career development and outlines the potential for drone sports in terms of career development. This paper highlights the critical role of STEM education and athlete development programs in shaping a sustainable career path for drone sports professionals. By considering the key findings from the review, a comprehensive career relevance study can be designed and developed to support the growth of drone sports as a viable career option. This study would focus on critical skills and knowledge, including STEM education, technical proficiency, and athlete development programs. The insights gained from this article can identify and support the next generation of drone sports athletes and professionals, contributing to the growth and success of this emerging field. The ongoing study in this area has the potential to shape the development of a sustainable career path for drone sports professionals, contributing to the continued growth and popularity of this exciting field.

Keywords: STEM education; drone sport; career development; athlete development

INTRODUCTION

Recently, there has been a growing trend toward integrating STEM concepts and skills with sports and athletics, resulting in the emergence of new and innovative sports programs. These programs aim to enhance athlete development by incorporating STEM-related concepts such as data analysis, biomechanics, and technology. The field of drone technology has grown rapidly in recent years, creating new opportunities for individuals with skills in Science, Technology, Engineering, and Mathematics (STEM). With the increasing demand for skilled professionals in the drone industry, there is a need for effective athlete development programs that can prepare aspiring athletes for successful careers in this field. This has led to the development of integrated STEM-Drone

Sport athlete development programs that combine traditional sports training with STEM education to create a unique training experience.

The objective of this study is to explore how an integrated STEM-Drone Sport's athlete development program can be designed to effectively prepare athletes for successful careers in the growing field of drone technology. This paper presents a conceptual framework that outlines the key components of an integrated STEM-Drone Sport athlete development program and highlights the potential outcomes and impacts of the program. By providing a comprehensive overview of the program design, this paper aims to inform stakeholders such as athletes, coaches, parents, educators, and industry partners about the importance of integrated STEM-Drone Sport athlete development programs in promoting career relevance and employment opportunities in the drone industry.

RELATED STUDIES

STEM EDUCATION AND ITS SIGNIFICANCE IN CAREER DEVELOPMENT

STEM education is an educational approach that integrates science, technology, engineering, and mathematics subjects into a cohesive curriculum. The goal of STEM education is to develop students' critical thinking, problem-solving, and analytical skills through hands-on, project-based learning experiences. STEM education is becoming increasingly important today, as many jobs and industries require a strong foundation in STEM subjects (Bybee, 2013). By incorporating STEM education into curriculum, students are better prepared for future careers in fields such as engineering, computer science, healthcare, and finance. STEM education also encourages creativity and innovation, as students are challenged to come up with new and unique solutions to real-world problems. (Kelley & Knowles 2016) suggested the urgency to improve STEM education globally due to the environmental and social impacts of the twenty-first century, which threaten global security and economic stability. (Kelley & Knowles 2016) argued that the complexity of these issues reaches beyond just helping students achieve high scores in math and science assessments. Besides, (Arlinwibowo, Retnawati, & Kartowagiran 2021) stated that STEM education should involve interdisciplinary integration, the engineering design process, the community of practice, and a supportive learning model.

Studies have reported the positive impact of STEM-education. One of the key reasons for the importance of STEM education is the role that STEM fields play in driving economic growth. STEM-related jobs are among the fastest-growing and highest-paying jobs in the global economy. The demand for workers with STEM skills is increasing across all industries, including healthcare, finance, and education. By providing students with a solid foundation in STEM subjects, they are better equipped to pursue high-demand, high-paying careers that drive economic growth. Grinis (2019) found that STEM jobs are associated with higher wages within both STEM and non-STEM occupations. This is also supported by (Cherrstrom, Lopez & Ashford-Hanserd 2022), which suggested that workers increasingly need STEM knowledge for workplace success and earn significantly more than those without such knowledge.

Furthermore, STEM education also plays a critical role in promoting innovation and creativity. Students who study STEM subjects learn to think critically, solve complex problems, and apply scientific principles to real-world situations (Rustaman, Afianti, & Maryati 2018). These skills are essential in driving innovation, developing new technologies, and creating solutions to the world's most pressing problems. Besides, Table 1 presented some of the STEM skills that are widely discussed in literature. From these skills, STEM education provides students with the tools they need to be creative and innovative thinkers who can make a positive impact on society. Besides, students indicated that STEM education increased their creativity and passion for the courses, as well as influencing their job choices (Ugras 2018).

TABLE 1. Examples of STEM skills include:

STEM Skills	Description
Critical thinking (Ardianti, Sulisworo, Pramudya & Raharjo 2020; Linh, Duc, & Yuenyong 2019; Utami, Vitasari, Langitasari, & Mulyati 2021)	The ability to analyze information, evaluate evidence, and solve complex problems using logical reasoning
Creativity	The ability to generate original ideas, develop innovative solutions, and think outside the box.
Communication (Bicer et al. 2017; Krajcik & Delen, 2017)	The ability to communicate complex ideas and information clearly and effectively, both verbally and in writing.
Collaboration (Krajcik & Delen, 2017)	The ability to work effectively with others, share ideas, and contribute to a team effort
Coding and programming	The ability to use programming languages to create software, websites, and other digital tools
Data analysis	The ability to collect, analyze, and interpret data using statistical methods and tools.
Mathematics	The ability to use mathematical concepts and principles to solve problems in a wide range of fields, from engineering to finance
Scientific inquiry	The ability to use the scientific method to design and conduct experiments, analyze data, and draw conclusions.

On the other hand, STEM Education can be valuable in career development. Career development is a process that involves exploring, planning, and executing career-related goals and aspirations. It requires an individual to assess their strengths, skills, interests, and values to determine the best fit for their career path. STEM education plays a critical role in career development as it equips (with the skills in Table 1) individuals with the necessary skills and knowledge to succeed in a rapidly evolving job market. STEM careers, such as data analysts, software engineers, and biomedical scientists, are in high demand and offer excellent opportunities for growth and advancement. STEM education also provides individuals with transferable skills such as problem-solving, critical thinking, and collaboration, which are essential in any career field. Therefore, a strong foundation in STEM education is beneficial for anyone pursuing a successful career. (Bicer et al. 2017; Krajcik & Delen 2017).

Furthermore, STEM education equips individuals with a wide range of skills that are useful in the workforce. One of the most valuable skills is problem-solving, as STEM education involves the development of analytical and critical thinking skills necessary to solve complex problems (Bicer et al. 2017; Krajcik & Delen 2017). Additionally, individuals who study STEM subjects often gain proficiency in data analysis and computer programming, which are highly sought-after skills in today's job market. The ability to work collaboratively and communicate effectively is another valuable skill that STEM education provides. Individuals who pursue STEM careers also develop strong attention to detail and the ability to stay organized, which are essential for success in fields such as engineering, science, and technology. Furthermore, STEM education often involves working on projects and conducting experiments, which helps individuals develop creativity, innovation, and experimentation skills.

From benefits of STEM education in career development context, STEM-related careers offer higher earning potential than other fields due to the high demand for individuals with skills in science, technology, engineering, and mathematics (Grinis, 2019). Many STEM-related careers, such as data scientists, software developers, and engineers, require specialized knowledge and expertise, making them highly valuable to organizations and industries. STEM-related fields also offer job security as the demand for professionals in these fields continues to grow. Advances in technology and changes in the economy have led to an increased need for individuals with STEM-related skills, creating a stable job market for those

pursuing careers in these fields. Individuals who pursue STEM careers often can work on cutting-edge research and technology development, which can be both intellectually stimulating and rewarding. STEM education is also essential to the global economy, as it drives innovation, creates new industries, and advances economic growth. STEM-related fields are critical to industries such as healthcare, energy, and manufacturing, which play a significant role in the global economy, which is explained by the significant demand of the world labor market for specialists in the STEM industries (Soroko, 2018). Individuals with STEM-related skills and expertise are in high demand and can contribute to economic development and prosperity at both the local and global levels.

OVERVIEW OF DRONE SPORTS AND THEIR POTENTIAL FOR CAREER DEVELOPMENT

Drones offer significant potential for career development in a variety of fields, such as aerial photography and videography, agriculture (Sylvester 2018), and construction (Bybee 2013). As drone technology continues to evolve and become more sophisticated, the demand for skilled workers who can operate and maintain these devices is expected to grow significantly in the coming years. Drone pilots, technicians, and data analysts are likely to be in high demand in these industries as they continue to adopt and integrate drone technology into their operations.

Recently, drone sports have gain attention as like the e-sport. Drone sport involve using remote-controlled drones to participate in various activities, such as racing, obstacle courses, and aerial acrobatics (Kiran 2022, Para 1). These sports have gained popularity in recent years due to advancements in drone technology and increased interest in remote-controlled devices. The importance of drone sports lies in their potential for entertainment, competition, and innovation. Drone sports provide a unique and exciting way for individuals to test their skills and compete with other. They also offer opportunities for creativity and innovation, as participants are encouraged to design and build their own drones. There are limited of studies related to drone sports, however, this article discovered that drone sports offer a range of career opportunities for individuals interested in pursuing careers in the drone industry.

On the other hand, drone sports have emerged as a new and exciting field for career development, offering a wide range of opportunities in the drone industry as shows in Table 2.

TABLE 2. Potential career as drone athlete/sport (Fédération Aéronautique Internationale)

Potential Career	Descriptions
Drone Pilot	Piloting drones for events, competitions, or other purposes.
Drone Technician	Maintaining, repairing, and upgrading drones and related equipment.
Drone Designer	Designing and building custom drones for specific purposes.
Drone Event Manager	Organizing and managing drone events, competitions, and races.
Drone Instructor	Teaching others how to fly drones and perform aerial maneuvers.

The growth of drone racing and other drone-related competitions has created a demand for skilled professionals in areas such as drone design, production, and piloting. Individuals interested in pursuing a career in drone sports may find job prospects in fields such as engineering, software development, and drone operations. Drone manufacturers and tech companies are also in need of professionals with skills in areas such as mechanical engineering, electronics, and programming to design and develop new drones for racing and other applications. To excel in drone sports, individuals must have a combination of technical skills and knowledge of drone technology, as well as the ability to fly drones at high speeds and navigate through complex courses. Strong communication, problem-solving, and critical thinking skills are also essential for success in this field. As the popularity of drone sports continues to grow, so will the demand for skilled professionals in the drone industry. This could lead to the creation of new jobs and increased opportunities for career development in the drone industry.

ATHLETE DEVELOPMENT PROGRAMS AND THEIR IMPACT ON CAREER RELEVANCE

Athlete development programs are initiatives designed to support the growth and development of athletes at all levels of competition. These programs typically involve a combination of coaching, training, mentorship, and other resources aimed at improving athletes' physical, technical, and mental abilities (Varghese, Ruparell & LaBella 2022). The importance of athlete development programs in sports cannot be overstated. These programs are essential for identifying and nurturing talented young athletes and helping them reach their full potential. By providing athletes with access to quality coaching, training facilities, and other resources, athlete development programs can help them develop the skills and attributes needed to succeed in their chosen sport (Millar, Clutterbuck, & Doherty 2020).

Studies have found that athlete development programs that provide comprehensive support and resources can help athletes develop the physical, technical, and mental skills

needed to succeed in their sport (Millar et al. 2020; Till et al. 2021; Yenneti, Kushwaha, Naval, & Singal, 2021). These programs can also help athletes build important social and professional networks and provide them with opportunities to compete at higher levels. Furthermore, athlete development programs can have a positive impact on athletes' career prospects outside of their sport. Through programs that focus on education and career development, athletes can acquire valuable skills and knowledge that can help them transition to new careers after their athletic careers have ended.

CASE STUDIES OF SUCCESSFUL ATHLETE DEVELOPMENT PROGRAMS

Athletes' success in any sport is mostly determined by their skills, talent, and dedication. Athlete development programs, on the other hand, are crucial in maximizing an athlete's potential and performance. Given the highly technical and complex nature of drone sports, the relevance of athlete development programs cannot be emphasized. An increasing number of successful programs development programs have evolved in recent years, with the goal of supporting the growth and success of drone sports. These programs are designed to help students develop important skills such as technical expertise, strategic thinking, and effective communication. They also give athletes the resources and assistance they need to achieve their greatest potential.

1. National Governing Body (NGB) Programs (Chambers & Lim, 2022). Programs are to oversee and develop a specific sport at the national level. NGB programs are responsible for creating and enforcing rules and regulations, organizing national competitions, and selecting national teams to represent the country in international events. For example, The Malaysian Athletics Federation Malaysia (MAF) is to oversee and develop athletics in the country, as well as to promote the sport and support athletes at all levels of competition.
2. Collegiate Athletic Programs (Zid et al. 2022). Many colleges and universities offer athletic programs that

- provide training and competition opportunities for student-athletes.
3. **Community Sports Programs:** Many communities offer sports programs for children and adults, including youth leagues, recreational leagues, and adult leagues. These programs can provide opportunities for skill development and competition in a fun and supportive environment.
 4. **Elite Development Academies:** Some sports have elite development academies that provide intensive training, coaching, and competition opportunities for highly talented athletes. Examples of these academies include the IMG Academy for tennis and soccer and the United States Tennis Association's Player Development Program.

Based on the successful existing model of athlete development model, there are number of critical domains can be found as shown in Figure 1.

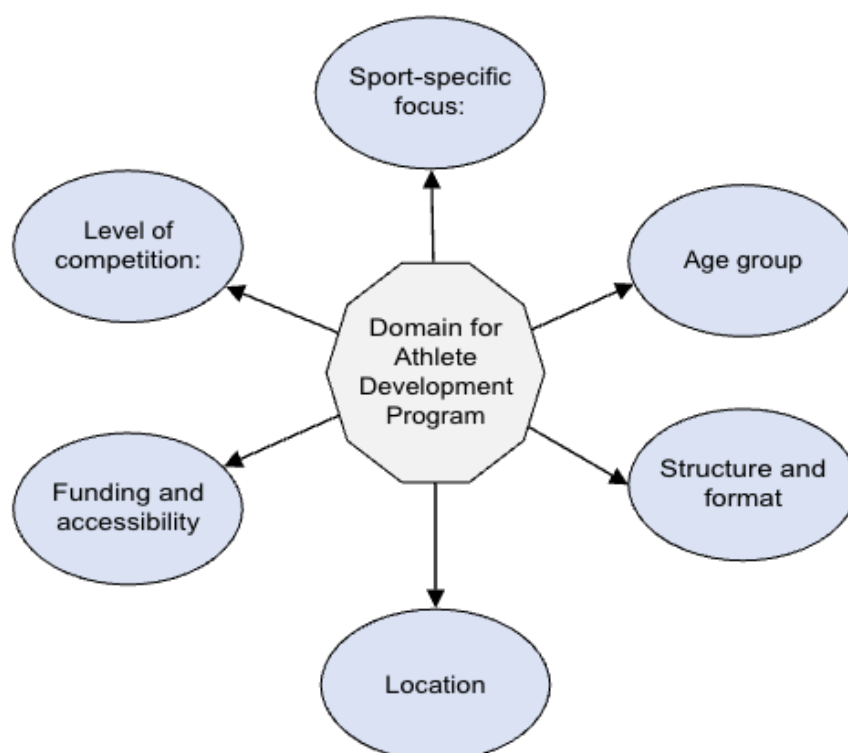


FIGURE 1. Some of the critical domain in designing athlete development programs

While athlete development programs share many similarities in their goals and objectives, there are also key differences between them (Chambers & Lim 2022; Kulwanich 2023; Suherman, Yassin, Rahayu & Sartono 2022; Zid et al. 2022). Some of the key differences among athlete development programs include: (i) Sport-specific focus: Some athlete development programs are designed to focus on a specific sport, while others offer training and support across multiple sports (Drikos, Barzouka, Balasas, & Sotiropoulos 2022). (ii) Level of competition: Athlete development programs can vary in the level of competition they focus on, ranging from community-based programs to elite programs that prepare athletes for national and international competition (García-de-Alcaraz & Marcelino 2017). (iii) Age group: Athlete development programs can

focus on specific age groups, such as youth, high school, or college athletes, or they may provide support and training for athletes of all ages (Booth, Cobley, Halaki, & Orr 2020). (iv) Structure and format: Athlete development programs can have different structures and formats, such as residential programs that provide full-time training and support or part-time programs that offer training and support outside of school or work hours. (v) Location: Athlete development programs can be in different settings, such as on college campuses, at sports academies, or within local communities. (vi) Funding and accessibility Athlete development programs can differ in terms of funding and accessibility, with some programs offering scholarships or financial support to athletes who may not have the resources to access training and support on their own. (Wicker & Frick 2020)

SUMMARY AND

DISCUSSION OF RESEARCH ISSUES

In summary, there are several factors that need to be considered in integrating STEM – Education, and athlete

development program for drone industry, especially drone sport (i.e. drone soccer). From the career relevance of point of view, we may elaborate this into two main research exploration, (i) integration of STEM knowledge and practice and (ii) career preparation as illustrate in Figure 2.

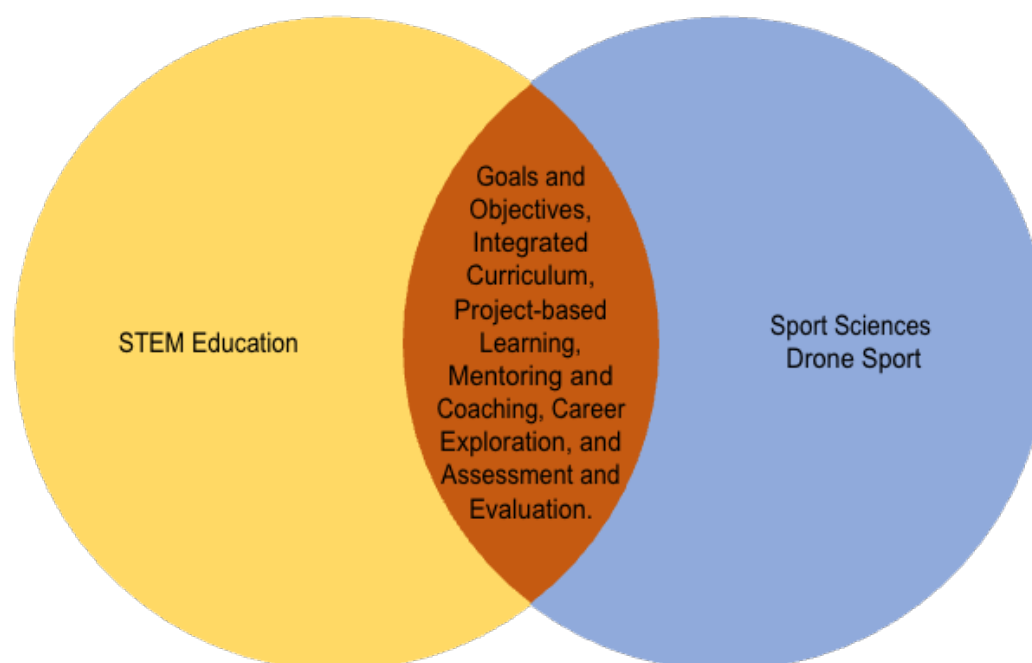


FIGURE 2. Proposed concept for integrated drone sport's with STEM Education in athlete development program

Firstly, integration of STEM skills and knowledge: The athlete development program should integrate STEM skills and knowledge required for success in the drone sports industry. This includes technical skills such as coding, drone design, and data analysis, as well as broader skills such as critical thinking, problem-solving, and creativity. By integrating these STEM skills and knowledge areas into the program, athletes can acquire the necessary skills for success in both their sport and future careers in the industry.

Besides, on career preparation perspective, the athlete development program should emphasize career preparation by providing athletes with opportunities to develop professional skills such as networking, resume building, and job interview skills. The program should also provide guidance on career paths and opportunities in the drone sports industry. This emphasis on career preparation can help athletes to transition successfully from their sport to their chosen careers and be better prepared for success in the industry.

From this perspective, this study may further investigate where the athlete is surrounded by the different components of the program, which are all designed to support their learning and development. These goals and objectives are based on the requirements of the STEM and drone sport industries and are designed to ensure that athletes are well-prepared for careers in these fields. The component ensures that athletes develop a deep understanding of both fields and can apply their knowledge to real-world challenges. The Project-based Learning component encourages athletes to apply their knowledge to real-world challenges. Projects are designed to help athletes develop skills such as critical thinking, problem-solving, communication, and collaboration. The mentoring and coaching component provides athletes with access to mentors and coaches who have experience in the STEM and drone sport industries. These mentors and coaches provide guidance and support as athletes develop their skills and explore career options. The career exploration component includes opportunities for athletes to explore career options in the STEM and drone sport industries.

CONCLUSION

In conclusion, the above four sections provide a comprehensive understanding of the importance of STEM education, the potential for career development in drone sports, athlete development programs and successful case studies. By taking into consideration the key findings from these sections, it is possible to design and develop a career relevance study that can support the growth of drone sports as a viable career option. Such a study would focus on the critical skills and knowledge required for success in drone sports, including STEM education, technical proficiency, and athlete development programs. Through this study, we can identify and support the next generation of drone sports athletes and professionals, who can contribute to the growing popularity and success of this exciting and emerging field. Ultimately, the insights gained from this study can help build a sustainable career path for those interested in pursuing a career in drone sports. These findings represent a starting point for further exploration into the skills and knowledge required for success in this emerging field. As such, ongoing study in this area has the potential to shape the development of a sustainable career path for drone sports professionals, while also contributing to the continued growth and popularity of this exciting field.

ACKNOWLEDGEMENT

The work described in this paper was supported by a research grant by Universiti Kebangsaan Malaysia, GGPM-2022-015.

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