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AviateOK: A STEM App to Increase K-12 Student Engagement in the Aviation and Aerospace Industry

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Abstract. STEM industries are driving technological and economic growth across the globe. To remain competitive, the U.S. needs to focus on the advancement of STEM education and develop a sustainable pipeline to provide a well-qualified workforce to STEM-related industries. The Department of Aviation and Space Education (AVED) at Oklahoma State University (OSU) has developed aviateOK, which is a STEM application, to provide aviation/aerospace content to students, parents, and extension educators. The aviateOK STEM application promotes extension education by providing access to free activities and resources for grades K-12. AviateOK equips 4-H youth programs with the resources needed for extension educators to provide a quality STEM education and ignite in students a passion for STEM.

INTRODUCTION

STEM (science, technology, engineering, mathematics) education provides students with the knowledge and skills to tackle complex challenges. It promotes scientific advancement, and the critical thinking, problem-solving, and analytical skills necessary for students to excel in a technologically advanced society. To remain competitive, the United States must continue to reinvigorate its STEM education system. STEM education at the K-12 level provides the necessary foundation for those pursuing the careers of tomorrow. Early STEM education is essential to creating a foundation for later academic development, as well as to preparing „today’s students for the jobs of tomorrow. Economists predict that as the United States enters the 2030s STEM-focused jobs, including job titles that did not exist ten years ago, will be among the fastest growing job opportunities (Formaspace, 2020).

Educational programs, such as the 4-H youth program, provide students the opportunity to pursue a STEM education. The 4-H youth program is the largest in America and is run by professional and volunteer Extension staff and educators who provide experiential learning opportunities for youth nationwide (National Institute of Food and Agriculture, n.d.-b). Increasing the interest in adopting STEM subjects is one part of the 4-H program, and the aviateOK application aligns well with this purpose. The aviateOK application was designed and developed to provide early exposure to STEM education and to encourage students of all ages to learn and explore in the aviation/aerospace field. Combining technology and education in the form of an application provides a powerful source of STEM learning. Students and Extension educators can download the free application onto their smartphones and tablets.

MISSION OF AVIATEOK

Educational applications offer an effective way to attract students to study and learn (Hirsh-Pasek et al., 2015). AviateOK provides Extension educators and students access to aviation/aerospace-related content and resources. The mission of the STEM mobile application is threefold:

- promote engagement and enthusiasm among K-12 students for learning about and exploring STEM-related educational materials specifically related to the U.S. aviation/aerospace industry,
- expose students to activities that captivate them in learning through innovative methods, providing ways to develop their own ideas and strategies and to visually engage with people, objects, and activities as they explore the world of aviation/aerospace, and
- provide content focusing on traditionally underrepresented populations, both demographically and geographically, promoting diversity and inclusion in the aviation/aerospace environment.

CURRICULUM, SUBJECT AREAS, AND LEARNING OUTCOMES

Introducing K-12 students to aviation/aerospace is an investment in the future of the U.S. aviation/aerospace industry. The AviateOK application was designed and developed to provide early exposure to STEM engagement and to inspire students of all ages to learn about and explore in the aviation/aerospace field. Unless someone in their family is in the aviation/aerospace industry, many young people will never consider the aviation/aerospace community as a career choice.

AviateOK provides beneficial STEM-related resources to students, parents, and Extension educators. More importantly, the application provides crucial educational resources, internship and scholarship opportunities, and aerospace camps necessary to develop the interest and knowledge of those students who have chosen to pursue a career in the aviation/aerospace industry. The available STEM resources for Extension educators assist them in locating and engaging in beneficial aviation/aerospace-related activities for their students. Students, parents, and Extension educators have access to all content areas of the application. For ease of use, the application is divided into eight navigational sections (Table 1).

UTILIZING AVIATEOK IN 4-H YOUTH PROGRAMS

The 4-H youth program utilizes positive youth development (PYD) to help students thrive. The PYD thrive concept as presented in the 4-H Thriving Model consists of four components: Sparks, Belonging, Relationships,

Table 1. aviateOK Navigational Sections

Section	Content
Flight Plan	Provides aviation/aerospace activities through links to websites as well as to content provided directly on the application for students K-12.
Air & Space Anywhere	Highlights virtual tour videos of aviation/aerospace organizations and facilities, along with corresponding career information. Provides videos on a broad spectrum of aviation/aerospace topics, with a focus on curricular content for Extension educators.
Flight Recorder	Provides a chronology of aviation/aerospace history in the United States. AviateOK users learn about significant aviation/aerospace events and their historical contributions to the development of the aviation/aerospace industry.
Image Gallery	Allows for submission of aviation/aerospace photographs to be posted in the gallery after being reviewed by the application administrator.
Active Runway	Highlights aviation/aerospace events planned across the United States, such as aviation/aerospace camps and airport fly-ins.
Touch & Go	Provides students, extension educators, and parents with aviation/aerospace STEM resources from organizations such as NASA and Air Force Research Lab.
Squawk (User Feedback)	Allows users the opportunity to provide feedback and recommendations regarding the aviateOK application.
T-Hangar (Teacher Resources)	Provides STEM-related educational resources for extension educators, including STEM training opportunities and aviation/aerospace curriculum.

AviateOK

and Engagement (Arnold, M. E., 2018). The Sparks component focuses on exposing students to new ideas and encouraging them to investigate areas that interest them, while the Engagement component promotes independent learning (National 4-H Council, n.d.). The aviateOK application directly aligns with Sparks and Engagement in that it allows students to explore aviation careers independently through their personal electronic devices or under the direction of an Extension educator in a more formal group environment. Additionally, the aviateOK application provides listings for upcoming aviation events that students can attend in person to further inspire and educate themselves regarding the variety of opportunities in the aviation industry.

The 4-H Extension programs promote the use of experiential learning strategies. David Kolb is credited with developing in the 1970s the experiential learning theory (ELT) that aligns well with STEM education (Kolb & Kolb, 2006). Kolb's ELT is a cycle of learning consisting of "concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE)" (Kolb, 2015, p. 42). The foundation for learning is first laid with students engaging in the learning experience (CE). The aviateOK application encourages users to experience aviation history, explore aviation careers, and engage their senses by viewing educational videos. The "Air & Space Anywhere" section of the application provides students with engaging virtual tours of facilities, such as the video tour of the air traffic control tower at Atlanta Hartsfield Airport. Students can then use the aviateOK application to connect feelings and ideas related to what they have experienced (RO) through photography. The "Image Gallery" section allows students to express their observations and creativity by submitting aviation/aerospace-related photographs.

Learners can test theories and ideas they formed (AC) using aviation/aerospace activities provided in the "Flight Plan" section of the aviateOK application. They can find educational materials that use experimentation to teach aviation-related concepts and principles. Finally, the aviateOK application enables students to test what they have learned by completing embedded quizzes. For example, students can view a video explaining Bernoulli's Principle and then complete a multiple-choice quiz within the application that allows them to test their comprehension of the material provided in the video. Students can better understand the aviation industry by experiencing all four stages of Kolb's theory.

The 4-H science program endeavors to provide quality science education, "promote science literacy," and "generate interest in science-related education and careers" (National Institute of Food and Agriculture, n.d.-a). The aviateOK application allows students to actively learn, share their experiences, and process their experiences. By incorporating the aviateOK application into the existing 4-H ELT process and science program, extension educators will be better able to help students apply what they have learned to situations outside of 4-H while generating the opportunity for students to learn about aviation career opportunities.

CONCLUSION

There has been tremendous improvement in the field of education through combining innovative technology with education. Technology has changed the way we teach and learn. Education is no longer restricted to lectures, classrooms, and physical objects (Consagous, n.d.). Now that Extension educators have a digital tool to assist in teaching K-12 students, schools must continue promoting STEM education using adaptive pedagogical techniques and evolving technology that encourages K-12 students to excel in STEM-related subject areas.

Regardless of socioeconomic status, students embrace technology for learning. The advancement of educational technology reinforces the need to consider efforts to engage students in STEM effectively. AviateOK was designed to promote student engagement and enthusiasm through learning about and exploring STEM-related educational materials that are specifically related to the aviation/aerospace industry. The STEM-focused educational efforts of the 4-H science program enable students to understand the relevance of what they are learning and apply their learning to problems in the real world.

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