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Aviation Maintenance Instructional Design: How to Teach the Millennial and Gen-Z Cohorts

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The Federal Aviation Administration's (FAA) 2019-2039 Aerospace Forecast suggests that aviation is a thriving industry expected to grow significantly over the next two decades. The United States saw an approximate 5.3% increase in the number of total passengers in 2018, as 245 million people traveled within and through the nation (FAA, 2019, p. 20). The FAA projects a steady increase in this statistic and estimates that 491 million passengers will take to the skies in 2039 (FAA, 2019, p. 20). Growth is not expected to be limited to passenger-carrying flights either. Consistent growth in gross domestic product (GDP) also leads the FAA to forecast an average annual cargo revenue ton miles (RTM growth) of 3.3% through 2039 (FAA, 2019, p. 22). As the business of aviation continues to grow, air carriers can expect to experience more wear on their existing aircraft, and a need to expand their fleets by adding new aircraft. All of these aircraft will need maintenance and projected growth in aviation should then be associated with a need to develop both existing and new aviation maintenance technicians.

A New Cohort of Aviation Maintenance Technicians

A New Type of Technician

To meet increased passenger demands, air carriers will need to ensure availability of their largest asset – their aircraft. Due to the increasing use of various technologies in aircraft and the modernizing of maintenance planning, future aviation maintenance technicians will work in a highly technological environment. This includes implementing predictive maintenance technologies and practices in order to decrease schedule interruptions such as delays and cancellations and unscheduled maintenance (Vianna & Yoneyama, 2018; Weerasinghe & Ahangama, 2018). Boeing's Airplane Health Monitoring (AHM) program is one example and uses continuous monitoring and analysis of aircraft systems performance and condition data to enable organizations to make decisions about what maintenance should be performed and when (Boeing, 2009). This new approach to maintenance planning will hopefully mean more maintenance can be planned for base visits, and less maintenance performed "on the line".

Other technological advances in the industry will impact the tools and documentation used for maintenance. Ceruti, Marzocca, Liverani, and Bil (2019) give the example of additive manufacturing, which enables the rapid production of components such as spare parts. Future aviation maintenance technicians may need a more in-depth understanding of the technology involved in additive manufacturing to allow them to quickly produce parts using computer-aided design (CAD) models. Other popular uses of CAD models are virtual reality (VR) and augmented reality (AR) technologies, which allow users to immerse themselves in simulated environments. It is quite possible that VR/AR capabilities

may render traditional technical publications, such as illustrated parts catalogs and task cards, archaic (Ceruti et al., 2019). Future aviation maintenance technicians must, therefore, also be adaptive and embrace new technologies.

Demand for Technicians

Boeing (2019) forecasts a need for 769,000 new aviation maintenance technicians to maintain the global fleet for the next two decades. In 2017, the Aviation Technician Education Council (ATEC) reported that maintenance technicians were retiring faster than new technicians could be trained to replace them; an estimated 30% of the workforce was of retirement age and the workforce expected to decrease by 5% by 2030, whereas new maintenance technicians made up only 2% of the workforce (ATEC, 2017, p. 1). The Aviation Technician Education Council (2017) also reported that 35% of recently graduated aviation maintenance technicians were high school students within one year of enrollment (p. 6). Census Bureau data indicate that the average aviation maintenance technician age was around 42 years between 2014 and 2017 (datausa, n.d). If the average age remains in the early forties, then many of the aviation maintenance technicians that will comprise the workforce over the next two decades are of the millennial or Gen-Z cohorts.

Millenial and Gen-Z Characteristics

Millennials are defined as those born between 1981 and 2000, and Gen-Z (also known as the post-millennial generation) as those born after 2001 (Niemczyk, 2017; Vojvodic, 2019). Both generational cohorts grew up with access to the internet and are associated with their technology usage, which leads to short attention spans, shallow thinking, and a need for instant gratification (Niemczyk, 2017, p. 9; Shatto & Erwin, 2016; Vojvodic, 2019).

The millennial generation was the first to grow up with the internet, portable technology (e.g. smartphones and tablets), and social media networking applications (e.g. Facebook), and researchers note their preference for the integration of these advances in education. As such, Au-Yong-Oliveira, Goncalves, Martins, & Branco (2018) gave the examples of distance learning and usage of media to convey information as helpful successful strategies for educating millennials. Millennials are also said not to have high literacy or mathematical skills upon high school graduation, due to the issues associated with overuse of standardized testing, which means they are not prepared for higher education or most entry-level jobs (Au-Yong-Oliveira, Goncalves, Martins, & Branco, 2018; Niemczyk, 2017).

Shatto & Erwin (2016) claimed that Gen-Z students are able to gather information very quickly via digital means but lack the skills it takes to analyze or comprehend it. Rodriguez, Boyer, Fleming, and Cohen (2019) also commented on Gen-Z's poor analytical and problem-solving skills, stating that they lead to a low

tolerance for ambiguity and a desire for strong leadership and clear instructions. Gen-Z students do not seem to differentiate between synchronous (scheduled) learning and self-guided learning, instead preferring a hybrid of classroom and virtual learning (Marron, 2015; Selingo, 2019). Rodriguez et al. (2019) further associate Gen-Z students with a preference for informal learning. Gen-Z is also said to lack many critical social skills, but may be great resources for older generational cohorts due to their technological skills (Marron, 2015; Roseberry-McKibbin, 2017).

FAA Training Requirements

In the United States, the basic requirements for aviation maintenance technicians are age (18 years or older), English comprehension, and demonstration of competency in both theoretical and applied concepts (FAA, 2015). The understanding of theoretical concepts is tested through written, oral, and practical examinations by FAA-approved test centers (FAA, 2015). Applied knowledge is acquired through "practical experience" with either power plants, airframes, or both; the FAA (2015) requires 18 months of experience with either power plants or airframes, and 30 months of experience when the prospective aviation maintenance technician is working with both. Practical experience can also be acquired through enrollment in FAA-approved schools.

Teaching Use of New Technology

The new cohort of aviation maintenance technicians, which consists of millennials and Gen-Z, can be described as "digital natives," or those who have been exposed to and use digital technologies throughout their lives (Ng, 2012; Gose, 2017). Ng (2012) stated that digital natives learn by doing, prefer visualizations, and to multi-task. The digitally literate, including digital natives, are theoretically adaptive and easily learn how to use new digital resources. Digital literacy includes photo-visual literacy, reproduction literacy, branching literacy, information literacy, and socio-emotional literacy (Ng, 2012); of these five characteristics, photo-visual literacy, branching literacy, and information literacy are the most important in the context of training aviation maintenance technicians. Photo-visual literacy, which involves the ability to discern visual information, and branching literacy, which involves the ability to navigate non-linear data and create complex mental models, are useful where additive manufacturing and the use of VR/AR technologies are concerned. Information literacy is the ability to assess digital (Web-based) data and is a critical skill for those involved in processing airplane health data. As the new cohort possesses attributes that enable them to adapt to future aviation maintenance trends, emerging technologies can and should be integrated into the curriculum immediately.

Teaching Millennial and Gen-Z Students

Niemczyk (2017) recommends a "4 A" learning model to educators of these younger students, to be complemented by micro-learning and industry interface. The 4 A is Active, meaning the instructor and student have high levels of interaction with each other and with the curriculum. For example, instructors may opt to deliver curriculum via web-based games or YouTube videos and provide immediate feedback (Cronk, 2018; Roseberry-McKibbon, 2017; Shatto & Erwin, 2016).

Instructors may find feedback from Gen-Z students valuable in continuously improving instructional design, as another example of Active learning. Instructors and students Associate concepts with what students may already know via case studies, acronyms and "chunking" and visual representations of concepts. Gen-Z students, for example, like learning about complex issues from documentaries (Marron, 2015).

Anticipation is used to illustrate how theoretical concepts may be encountered in life or in the workplace, which is critical to incorporate into the instructional design when students are of the Gen-Z generational cohort (Roseberry-McKibbon, 2017). Awareness involves self-assessment by the student, and evaluation by the instructor (Niemczyk, 2017). Selingo (2019) cites VR/AR technologies as ideal tools for both practicing concepts and demonstrating mastery; this is an example of Active learning, Anticipation, and Awareness. Through micro-learning, instructors can accommodate students' short attention spans by deploying modular lesson plans or assignments. Industry interface, which may be as simple as exposure to a guest speaker, can satisfy the Anticipation aspect of the 4 A learning model by exposing students to the workplaces they may eventually join (Niemczyk, 2017; Roseberry-McKibbon, 2017).

Conclusions and Recommendations

Educators of future aviation maintenance technicians must start revamping and piloting their curriculum today in order to meet industry needs now and in the future. Aviation is experiencing many technological advances, including implementation of aircraft health monitoring, additive manufacturing, and VR/AR technologies at points where they will affect maintenance technicians. Luckily, the new cohort of aviation maintenance technicians will likely consist primarily of millennials and Gen-Z, who are notorious for their affinity for digital technology. While many associate this characteristic with negative outcomes, such as a need for instant gratification and lack of social skills, an affinity for digital technology is actually a great strength of the new cohort. These maintenance technicians will be able to solve problems independently and are comfortable receiving and providing feedback immediately, which can be used to make changes much earlier in many processes. Their digital literacy and willingness to implement

technology in new ways means they will be ready to help integrate technologies like health monitoring, additive manufacturing, and VR/AR into the traditional world of aviation maintenance.

Niemczyk's (2017) 4 A model is a simple model that educators can easily use to create and deploy maintenance training while maintaining the standards set forth by the FAA for training. Specifically, offering modular, virtual training can assure students' attention is maintained and theoretical concepts learned. Interactive tools and games may provide variety in curriculum delivery, so students are not only receiving information via written means. New technologies should be incorporated into the "practical experience" modules, and schools may find it easier to do this by partnering with industry and providing students opportunities to see the exciting work they will be doing first-hand.

References

ATEC. (2017). *Pipeline report*. Retrieved from http://www.atec-amt.org/uploads/1/0/7/5/10756256/atec-pipelinereport-20171211.pdf

Au-Yong-Oliveira, M., Goncalves, R., Martins, J., & Branco, F. (2018). The social impact of technology on millennials and consequences for higher education and leadership. *Telematics and Informatics, 35*(4), 954-963. https://doi.org/10.1016/j.tele.2017.10.007

Boeing. (2009). Monitoring real-time environmental performance. *AERO Magazine, 03*(09). Retrieved from https://www.boeing.com/commercial/aeromagazine/articles/qtr_03_09/article_07_1.html

Boeing. (2019). *Pilot & technician outlook 2019-2038*. Retrieved from https://www.boeing.com/commercial/market/pilot-technician-outlook/

Ceruti, A., Marzocca, P., Liverani, A., & Bil, C. (2019). Maintenance in aeronautics in an Industry 4.0 context: The role of augmented reality and additive manufacturing. *Journal of Computational Design and Engineering, 6*(4), 516-526. doi: 10.1016/j.jcde.2019.02.001

Cronk, R. (2018). Matching audience with game elements for maximum engagement. *European Conference on e-Learning,* 107-115. Retrieved from http://ezproxy.libproxy.db.erau.edu/login?url=https://search-proquest-com.ezproxy.libproxy.db.erau.edu/docview/2154983353?accountid=27203

datausa. (n.d.). *Aircraft mechanics & service technicians*. Retrieved from https://datausa.io/profile/soc/aircraft-mechanics-service-technicians#demographics

FAA. (2015). *Become a mechanic*. Retrieved from https://www.faa.gov/mechanics/become/

FAA. (2019). *FAA aerospace forecast fiscal years 2019-2039*. Retrieved from https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2019-39_FAA_Aerospace_Forecast.pdf

Gose, B. (2017). Gen Z changes the debate about devices in the classroom. *The Chronicle of Higher Education.* Retreived from https://www.chronicle.com/article/Gen-Z-Changes-the-Debate-About/241163

Marron, M.B. (2015). New generations require changes beyond the digital. *Journalism & Mass Communication Educator, 70*(2), 123-124. doi: 10.1177/1077695815588912

Niemczyk, M. (2017). Generational shift: Why we should modify our instructional strategies for the next generations of aviators. *National Training Aircraft Symposium (NTAS) 2017 – Training Pilots of the Future: Techniques & Technology.* Retrieved from https://commons.erau.edu/ntas/2017/presentations/28

Ng, W. (2012). Can we teach digital natives digital literacy? *Computers & Education, 59*(3), 1065-1078. doi: 10.1016/j.compedu.2012.04.016

Rodriguez, M., Boyer, S., Fleming, D., & Cohen, S. (2019). Managing the next generation of sales, Gen Z/millennial cusp: An exploration of grit, entrepreneurship, and loyalty. *Journal of Business-to-Business Marketing, 26*(1). doi: 10.1080/1051712X.2019.1565136

Roseberry-McKibbon, C. (2017). Generation Z rising: A professor offers some hints on engaging members of gen Z, who are taking college campuses by storm. *ASHA Leader,* December 2017. Retrieved from https://link.gale.com/apps/doc/A517878600/AONE?u=embry&sid=AONE&xid=11990ce8

Selingo, J. (2019). How to teach the diverse cohort of gen Z students. *The Chronicle of Higher Education, A35*. Retrieved from http://bi.gale.com.ezproxy.libproxy.db.erau.edu/essentials/article/GALE|A563081736?u=embry

Shatto, B., & Erwin, K. (2016). Moving on from millennials: Preparing for gen-Z. *The Journal of Continuing Education in Nursing, 47*(6), 253-254. doi: 10.3928/00220124-20160518-05

Vianna, W.O.L,. & Yoneyama, T. (2018). Predictive maintenance optimization for aircraft redundant systems subjected to multiple wear profiles. *IEEE Systems Journal, 12*(2), 1170-1181. doi: 10.1109/JSYST.2017.2667232

Vojvodic, K. (2019). Generation Z in brick-and-mortar stores: A review and research propositions. *Business Excellence, 12*(3), 105-120. doi: 10.22598/pi-be/2019.13.1.105

Weerasinghe, S. & Ahangama, S. (2018). Predictive maintenance and performance optimisation in aircrafts using data analytics. *2018 3rd International Conference on Information Technology Research (ICITR)*. doi: 10.1109/ICITR.2018.8736157