AVIATION TRAINING

From Knowing to Doing: Continuous Learning via Scenario-Based Training

A white paper from
Emirates and CAE

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Background: From ‘Knowing’ to ‘Doing’

Despite the apparent decades of advancements, the approach to learning and development we witness in society today still appears to be the same, whether it be classroom lessons in schools, lectures at universities and the traditional format of pilot training in the aviation industry. Even though there are many examples of new classroom technology, interactive software solutions and new forms of simulation, any progress made has often been driven by technology rather than being determined by learning considerations.

Promising technology has been slow to deliver improved learning or may not have even delivered at all. The focus on technology rather than learning has too often missed the needs and context of the learner as well as the implementation and application of the new technology. In aviation, the emphasis on technology is understandable and has been complemented by a focus on compliance with regulations. Until the development prompted by AQP/ATQP, followed by EBT/CBTA, the progress of training methods was slow and led by individual initiatives rather than industry wide progress. The framework of EBT/CBTA has prompted development of methods, with focus on competencies and trainer interaction with trainees. However, despite the great advances in simulation, the development of the actual content for simulation training has not advanced at the same pace. Beyond training in the full flight simulator, there is still potential for improvement in both the development and implementation of new methods of learning.

Having said the above, significantly more progress has been made when the focus has been placed upon learning methods rather than technology itself. Universities have created whole programs which are based upon case studies, with no traditional lectures remaining in the curriculum. There are many positive examples of new methods and technology delivering on the interaction and engagement that facilitates learning and retention. There are best practices to learn from in other fields regarding how to deploy new methods and technology in a learner-centered manner.

By stepping back from the focus on technology and looking at a bigger picture of learning in the aviation industry, a focus on integration of new methods and technology, in that order, should be able to advance pilot training from where it is today.

An important part of a vision to improve learning in pilot training would be to move it towards ‘implementation’. In other words, rather than learning per se, the emphasis would be placed upon what can be done with what has been learned. The acquisition and retention of knowledge will remain important, but the road forward to apply this knowledge should be facilitated by new methods and technology.

The nature of the pilot professional culture is that pilots are ‘doers’ and their contribution to safe and effective flight is action, whether proactive or reactive. The doer culture means that it can be difficult to motivate pilots to solidify knowledge on things that come across as theoretical to them. However, if a focus on knowledge can be combined with a bridge to action, then this would be a far more effective concept to apply to pilot training. This paper therefore argues that Scenario-Based Training (SBT) provides the means for Learning and Development to transition from ‘Knowing’ to ‘Doing’. This relationship will now be explored in further detail.

A Vision for Scenario-Based Training

The overall vision for promoting continuous learning for pilots via Scenario-Based Training (SBT) is summarised as follows:

- Concentrated to Continuous (Time)
- Compliant to Compelling (Content)
- Compulsory to Cooperative (Trainee)

Concentrated to Continuous (Time)

To realise continuous learning, there is a need to move away from relying on a recurrent training cycle for discreet events, and which is performed annually, to training for exceptional events within a continuous time frame. Timing for learning is important and there are individual variations regarding when, how long and how often people learn best. The use of spaced repetition has proven supportive of learning and concepts of microlearning have made use of this. Rather than relying on a few events packed with content, pilot training should be distributed over time to be supportive of learning and reinforcement of learning. There are already apps available for this, which distribute content and questions on mobile devices and use the data for analysis. Embedded training, where training is integrated in operations and provides learning synergies, is another way of achieving this.

Compliant to Compelling (Content)

The aim here is to reduce the focus on what is required by regulation when developing content and ensure that the content is relevant and useful. The EBT/CBTA framework has provided opportunity to do this, but in addition to being relevant and useful the content should be interesting and so well presented that it attracts attention rather than repels it. The development of training material is often inadequately resourced with the result being suboptimal material which is boring and unengaging. The training should be developed to a standard that makes pilots want to learn, rather than rely on forcing pilots to learn. There have been positive examples of this in recent years with blogs, videos, podcasts and simple simulation that pilots find and learn from because they 'want to' rather than because they 'have to'.

Compulsory to Cooperative (Trainee)

The principal aim is to remove the mandatory nature that is plaguing pilot training today, which works as a strong demotivator for learning. Ideally, the training should be seen as cooperation between the individual pilot, colleagues, and company (and regulator) aimed at achieving safe and efficient operations. This does not mean that regulatory compliance or record keeping would not be in place, but simply that pilots would be empowered to do a lot of their training on times of their choosing. If some fail to meet the planned training targets, there will be reminders and stopgaps. However, as much as possible training will be provided and it will be up to pilots to manage their learning so that it best fits their learning needs and life situation. The deployment of Cold Weather Operations (CWO) training provides a useful illustration. In order that the regulatory requirement is met, CWO training is deployed prior to the onset of northern hemisphere winter. With a cadre of pilots on a six-month cycle, this can mean that the pilots in the initial part of the training cycle can have a 7-to-8-month gap between training and having to deploy the training in an actual operational situation. The cooperative route would allow the training and experience be more closely coupled.

A Vision for Scenario-Based Training

The Learning and Development Pyramid depicted in Figure 1 proposes how the vision for Scenario-Based-Training can be achieved.

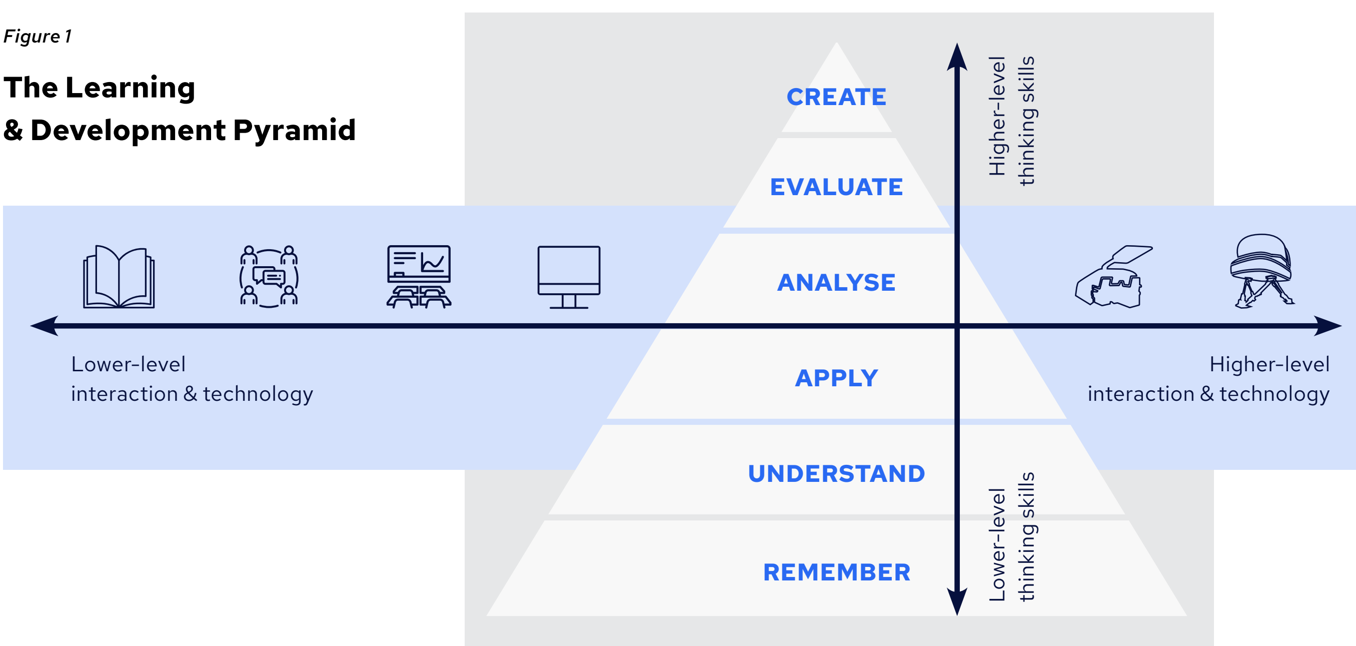
In Figure 1, levels of learning, as per Blooms Taxonomy (Remember-Understand-Apply-Analyse-Evaluate-Create), are depicted on the y axis. This represents simple levels of learning to the bottom (e.g. recall instructions, technical knowledge) and advanced to the top (e.g. ability to analyse a complex situation, evaluate own performance, come up with new solution to problems etc.). The y axis is overlaid with an x-axis showing different modes of learning (reading manual – discussing – group task in classroom – Simulation for Experiential Training (SET) – Computer-Based Training (CBT) – procedure trainers – aircraft simulators, etc.). The x-axis represents lower levels of interaction and simple technology to the right, and higher levels of interaction and advanced technology to the left.

Additionally, Figure 1 considers which modes of learning are supportive of different learning goals, while balancing effectiveness and cost, with the aim of finding the most efficient modes. With all the different methods and technology available, there is a risk that the options may overwhelm and that choices are made based on random opportunity or even the most convincing sales pitch. This is why it is important to strategically think through and plan which modes that should be used, how much they should be used and what learning targets they aim to meet.

Regardless of choice of mode, resource limitations will be always present. It is important to remember that any method or technology will only be as good as the development of content allows. Too often methods and technology, especially technology, have been compromised by content that does not optimise the potential of the method or technology. While the investment in technology can be both assessed and motivated, the investment needed in content development is often underestimated. This has been a major contributing factor to underperformance of and disappointment in some of the newer methods and technologies for training that have appeared in recent years.

Figure 1

The Learning & Development Pyramid

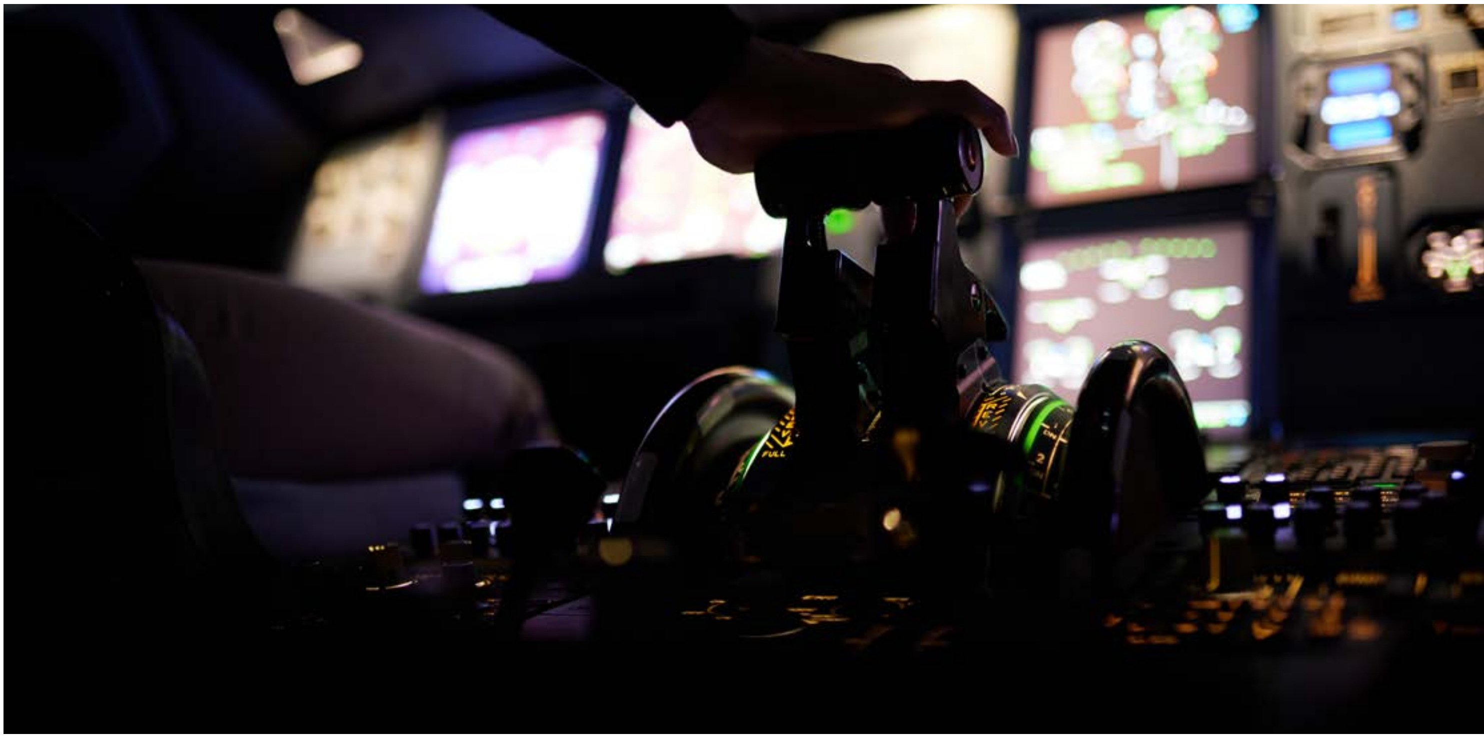


Scenario Based Training – Motivation

Pilot training and training in aviation in general has in recent times not been able to follow the development of learning technology and methods in other parts of society. The goals for pilot training have been clarified with the recent focus on competencies via EBT/CBTA. Accordingly, simulator training has been developed to be more balanced in focusing on the improvement of all competencies, rather than solely on checking of technical knowledge and skills. However, many of the other traditional methods of training used for pilots are not effective in producing knowledge that can be applied, e.g. multiple-choice questions are more about recall than understanding.

A focus on scenarios can put learning on context. When a scenario is used to develop knowledge and skills, the context is already in place and the distance to bridge to reality is minimal. In one sense, that is what a simulator can deliver – a scenario with a level of interaction as close as possible to real flight. However, scenarios can be applied with different methods and delivered by using different types of technology.

A traditionally powerful strategy for conducting pilot Crew Resource Management (CRM) training has been the use of case studies. While some of the more famous events can be overused to the point of cliché, their power lies in the narrative and how the story is told. ICAO Annex 13 reports are not always the best vehicle to communicate the actual context in a broadly meaningful way. Pilots are generally interested on the aspects of an accident report that gives them insight into the sensemaking that took place in the flight deck. The careful reading of a report to extract these lessons is a particular challenge and can be a barrier to learning. This even extends to an event that took place in their own airline. One of the roles of a good CRM facilitator is to act as the interface or translator of some of the dryer reports and weave them into an engaging story. This then allows the pilots to better simulate the scenario in their mind, perhaps considering how they would have dealt with something similar.



Scenario Based Training – Motivation

Similarly, when a pilot brings up a recent experience in classroom training, their colleagues are in their heads, simulating the same scenario. Scenarios can be used in a simple form, as an example a short description or single picture can be followed by the question "What will happen next?", to develop understanding and situation awareness. Scenarios can be discussed in classrooms, provided for discussion on online forums, delivered on a mobile devise along with questions etc. Previous work on Simulation for Experiential Training (SET) (see Dahlstrom et al, 2022) demonstrated that a thoroughly developed scenario can be delivered with via a tablet and provide significant training value, as the cognitive aspects of a scenario can be effectively simulated without replicating the physical environment. Desktop flight simulation should be able to provide similar experiences if suitable scenarios are developed for it. In short, there is a whole spectrum of methods to deliver training that are scenario based, rather than in traditional formats.

There is no reason that pilots should have to trawl through new features of cockpit technology, updates of procedures or changes at airports only by reading documents. By using scenarios, or even better – simple simulation, they should be able to interactively learn about these things. Changes to a weather radar could be tested in a simple scenario using a part-task desktop simulation. An on-screen representation of the cockpit could allow for trying out changes to a pre-flight cockpit setup. A change in an approach to an airport could be "flown" using simple simulation. This scenario-based training would also provide direct feedback to the organisation in the form of trainee behaviour associated with the simulation. As an example, if a flight operations department decided to change a policy regarding weather avoidance by specifying a minimum safe horizontal distance, the identical scenario can be run with and without the proposed rule to gauge the resultant pilot behaviour and change in operational risk.

An additional reason to use scenarios is that the level of safety in current operations means that the exposure to unexpected and unusual events for junior pilots is more limited than ever before in aviation. While this is the result of a positive development of operational safety, it also means that the development towards expertise for junior pilots is not supported by exposure to events to learn from (and for senior pilots the retention of expertise is not supported for the same reason). Providing exposure to as many scenarios as possible is not only a more effective way to develop and maintain knowledge and skills and the requisite variety of experience required in the role: It is the only way to compensate for the learning that no longer happens from operational experience the way it used to.

Scenario Based Training – One Specific Way Forward

Previous research on 'accelerated expertise' (see Hoffman et al, 2013) has validated the effectiveness of using scenarios and research on using the "Shadow Box" strategy has validated a specific method (see Klein and Borders, 2016). The Shadow Box method is in one sense nothing more than a refinement of what has been used in previous pilot training, i.e., a step-by-step scenario with decision junctions where the trainee must respond. These junctions can pose questions as to what the trainee would look for in a particular situation, which threats that would be considered, what would be top priorities and what decisions would be made. The system provides feedback to the trainee response in the form of them being shown experienced expert responses, along with information or data relevant to the situation. In this way the trainee can learn from experience and expertise, with also gaining immediate feedback on their performance.

Software can facilitate delivery of Shadow Box scenarios, and thus a library could be developed to meet training needs for the whole pilot demographic as well as address any emerging operational issues. Additionally, recurrent training needs can be identified in the EBT/CBTA process and in common with the argument for simple simulation above, in turn, provide a form of evidential data. This could support training in simulators by offering opportunity to develop competencies before the simulator training, and thus increase training quality and reduce failure rates. Scenarios that are rare and thus rarely can be fitted into simulator training could be brought up for reinforcement as ShadowBox scenarios. The vision here is the same as for SET, which provides more interaction but also requires more software development. For Shadow Box scenarios, only a framework would need to be developed. Beyond that, the number of scenarios can be built without additional software development and a library could be more quickly realised.

It is important to provide a reminder that the development of scenarios that maximise learning requires great effort. Through recent years of work and experience with this subject, it remains one of the most underappreciated and misunderstood aspects of pilot training. The primary focus on technology remains, together with the naïve notion that higher fidelity equals better training, especially for training in full flight simulators. While it is assumed that increased realism delivers quality training, it is unfortunate that the under-development of scenarios means that the potential for effective training remains unfulfilled.

Concluding Comments

One of the most cited models for practical learning is the experiential training cycle, i.e. using the stages of Concrete Experience – Reflective Observation – Abstract Conceptualisation – Active Experimentation (or simplified: Do something - Think about it - Discuss what it means and how it can be used – Try to see it if works). The concrete experience and active experimentation parts are still today too often missing in pilot training. Beyond the effective but expensive tools of simulation, the majority of pilot training is still only about input, i.e. pilots reading documents. An increased focus on scenario-based training and delivery of different modes of it across multiple channels would bridge theory and practice and by doing so increase quality and efficiency of pilot training. Development of the Shadow Box method, as well as continued work on Simulation for Experiential Training (SET) are two modes which can deliver such training.

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