COMPUTER BASED TRAINING: ADVANTAGES AND CONSIDERATIONS

As we become ever more automated, opportunities for ever more creative ways of delivering training emerge. Classroom sessions, whilst still a necessity are now being supplemented by computer based training (CBT) sessions that can be undertaken at work, at home, on the job or even whilst away. What can CBT provide that classroom training cannot and what should the airport or airline consider before investing in any one product? Adrian Schwaninger proffers answers.
In its early days, CBT was conducted on standalone computers and training was delivered via floppy disks. A sometimes still used definition of CBT refers to standalone computer mediated training which is delivered using CD ROMs or DVDs. The term web-based training (WBT) emerged for training conducted via the internet using a web browser. E-learning refers to all kinds of electronically supported and mediated learning although the term is now often linked to learning and training activities using internet technology. In the more recent literature the terms CBT, WBT and e-learning are often applied similarly or even interchangeably. A broader definition of CBT refers to all forms of self-paced distance training and learning activities using computers. In this article this broad definition is used in contrast to training delivered by an instructor in a classroom.

Advantages of CBT
Several advantages have been associated with CBT compared to traditional classroom training. CBT can be developed once and then be used to train a large number of people in a standardised way. This is especially relevant for skills, knowledge and competencies in aviation security that are required uniformly in different countries. While in classroom training, learning progress is determined by the instructor and the whole class, CBT is self-paced. This means that learners can progress at their own speed and repeat course content as needed which can make training more efficient. In addition, CBT can be individually adaptive, so that learning sessions are created by sophisticated algorithms taking into account learning progress and individual strengths and weaknesses. This is of particular importance in X-ray image recognition training where X-ray screeners have to learn how to recognise a large number of prohibited items in different rotations (e.g., Schwaninger, 2004b; Koller et al., 2008). Modern CBT features multimedia including images, text, audio, video, and allows activating multiple senses which increases knowledge retention (e.g., seeing the explosion of an improvised explosive device (IED) made with 50 vs. 500 g of TNT in a video will be memorised much better than when a trainer explains it). CBT systems can adapt to different learning styles by presenting information in audio, visually or both. Customisation is possible by allowing students to focus on course content that they do not know yet or is of particular importance to them (e.g. if cabin baggage screeners are trained in hold baggage screening). Modern CBT provides user interaction, like in computer games, which can make training more interesting and motivating than listening to an instructor. Moreover, using sophisticated computer simulation, responses to situations can be trained which in reality would be dangerous and/or expensive (like for example flying and landing an aircraft in different weather conditions). CBT allows one to measure learning progress and skills, knowledge and competencies acquired, using objective, fair, reliable, valid and standardised tests, which is difficult to achieve by an instructor alone (for the assessment of X-ray image interpretation competency see Koller and Schwaninger, 2006; Schwaninger et al. 2006). Finally, well developed CBT provides feedback to students on their learning progress which increases motivation.

Other advantages of CBT compared to traditional classroom training are not yet fully available in aviation security training. If CBT is delivered over the internet, students can learn at home. This means substantial cost savings because no scheduling is needed and costs for training facilities, instructors, travel fees and student materials can be saved. However, since aviation security course content often contains security sensitive information and because current CBT systems do not feature the high level of security such as, for example, internet banking applications (secure internet connection, authentication using mTAN, etc.) this advantage is still limited in aviation security training.

Problems and Solutions
There are several reasons why CBT still is not as widely used as it could be in many sectors and particularly in aviation security. Most of these issues can be overcome by using modern CBT technology in combination with face to face interaction and instruction (blended learning).

Most adults are not used to CBT because they only know and are used to traditional classroom instruction from school. This problem can be substantially reduced by providing a face to face introduction in order to motivate students at the very beginning and explaining to them the many benefits of CBT. If this is followed by an interesting game-like session including multimedia and an instructor who helps students using the system, the introduction can be very successful. Critics of CBT have pointed out that people cannot ask questions, which limits its effectiveness. With blended learning this problem can be reduced.
by conducting periodical classroom sessions in which the learning content is discussed both in groups and with the instructor. Hands-on exercises further increase knowledge acquisition and retention and allow transfer into practical skills. In addition, modern CBT provides collaborative technology in which students can exchange information in discussion groups, create a wiki, ask questions to the instructor etc. A problem with these modern CBT technologies is that current generations of aviation security personnel are not used to it. However, this will most probably change in some years, if one takes into account that most teenagers of today are frequently using web 2.0 technologies such as Facebook, Twitter, etc. Finally, sceptics of CBT have pointed out that quality of learning cannot be as high as when delivered by an instructor. This potential drawback can be substantially reduced when CBT is developed in close collaboration between subject matter experts, instructional designers, graphic artists and good programmers.

**What Makes For Good CBT?**

As shown in the previous sections, the potential of CBT is huge both in terms of efficiency and effectiveness. Unfortunately, many current solutions are of low to medium quality, which is especially true in aviation security. An important reason is that in order to create good CBT, substantial resources and knowledge is needed. First, a needs and task analysis has to be conducted in order to determine which skills, knowledge and competencies are required to achieve good job performance. To do this properly in aviation security, especially for tasks which entail a lot of human-machine interaction (e.g. working at a security checkpoint), human factors knowledge and expertise is required. Another important step is defining training objectives (desired outcomes of the CBT activity). This is relevant both for instructional designers and developers and is essential in order to be able to evaluate the training properly. Special attention should be paid to instructional design which often uses a blended learning approach in which CBT is combined with classroom training (e.g., Sury et al., 2011). A good CBT also requires graphic designers who develop intuitive screen designs, user friendly interaction as well as motivating and
effective multimedia content. Aviation security subject matter experts are essential in order to provide accurate learning content. The CBT package is usually created using authoring software or general purpose software such as Microsoft Silverlight or Adobe Flash. A good CBT contains lessons, questions as well as pre- and post-tests in order to provide feedback to the learner, to measure learning progress and training effectiveness. Sophisticated systems are individually adaptive (e.g. Schwaninger, 2004b) and provide means for reviewing course content and customisation. If appropriate, CBT can be designed like a computer game, sometimes even featuring realistic computer simulation.

In short, creating good CBT requires profound knowledge in different areas, substantial resources and carefully structured and planned collaboration in the development and management process.

Limitations of CBT
Not everything can be learned using CBT. There are many skills which require interaction with and feedback from a subject matter expert in order to achieve and maintain good performance on the job. While the knowledge about how to react correctly if an improvised explosive device is identified in cabin baggage can be acquired using CBT, it is a different matter to react properly at a real aviation security checkpoint. Another example is the pat down search. In theory, the procedure can be learned using CBT but whether a security officer is able to conduct the pat down properly needs to be verified by an instructor.

As explained in previous sections, for many applications, CBT should be combined with traditional classroom instruction in order to be effective (blended learning). This should entail face to face instruction at the beginning and guidance during the first CBT lessons. It is a good idea to define deadlines until when certain CBT courses have to be completed, including computer-based and practical tests to verify an increase in knowledge, skills and competencies. Periodical classroom sessions allow students to ask questions and review key aspects in the group and with the instructor. CBT needs to be closely related to the job and linked to specific on the job performance objectives. If students have successfully completed a CBT programme this does not yet guarantee that they apply the acquired knowledge and skills later on the job. Efforts should be made so that students can apply the acquired knowledge and skills as soon as possible on the job and this should be verified by an instructor who can provide feedback in addition to the CBT, which should be made available for reviewing and refreshing even after completion. In short, the effectiveness of CBT relies largely on the preparation, planning and management that go with it.

Evaluation of Training Programmes
Evaluation is essential in order to determine the quality of training programmes and whether they meet the required learning objectives. This section contains key points based on a recent paper on training evaluation in aviation security (Sury & Schwaninger, 2011). For training evaluation to be effective, it needs to be an integral part of an individual’s learning and development and should be an ongoing process rather than a singular event. Training evaluation is important as it ensures that the intended outcomes from the training were achieved and that they offer a sound return on investment. In order to evaluate a training programme, a well-established method by Kirkpatrick and Kirkpatrick (2006) suggests four progressive steps of evaluation: Reaction, learning, behaviour, and results. The first stage is concerned with trainees’ reactions to the training programme, i.e. whether they liked it or not, whether they thought it was relevant for their jobs or
The behaviour stage deals with the question of whether the newly acquired knowledge is being transferred into the trainee’s daily work or not. For this purpose, various methods of observational, interviewing and operational performance measuring techniques can be used to assess a trainee’s performance on the job. This allows deriving the impact of the training programme when comparing the current performance with the previous performance data from the time before the training programme. The results stage asks whether the training programme was economically beneficial or not. After all, there is no sense in introducing a new training programme on a wide scale if the cost is too high in relation to the additional benefit it provides. The challenge here is to find the key performance indicators (KPI) that validly represent the trainees’ performance. Judging people by using bad KPIs is ethically questionable, unfair, and decreases the trainees’ motivation, as they might feel that no matter how hard they try, they have no influence on the result.

Aspects to be considered before investing in any one product

It follows from the previous sections that in order to select a good CBT system several aspects should be taken into account. The following list contains questions that should be addressed before investing in any one product:

1. Is the content compliant with international regulation (EC 185/2010) and can it be customised to national and airport specific aviation security training and testing regulations?
2. Was the CBT developed using a well-structured and managed process involving subject matter and human factor experts, instructional and graphic designers as well as professional software developers?
3. Is consulting provided on how to introduce the CBT in your company?
4. Is the system easy to use for students and instructors?
5. Does the CBT contain reliable, valid and standardised tests to provide feedback and measure learning progress and training effectiveness?
6. Are there management functions available for tracking learning progress and behaviour of learners?
7. Does the CBT provide functions to define organisational units and different assignment of screeners to courses?
8. Has the effectiveness of the CBT been proven by scientific studies and does the provider know the key principles of training evaluation?
9. Is the CBT individually adaptive and does it provide means for reviewing course content and customisation?
10. Has the developer a suite of products and does he invest into research and innovation?
11. Does the manufacturer provide updates and is the technical support sufficient for your business needs?
12. Does the system run on your current and hard- and software environment including bandwidth requirements?
13. Can the CBT be connected to an existing learning management system?
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References


