IMPROVING SECURE HANDLING OF AIR CARGO BY MEANS OF WEB BASED BLENDED LEARNING

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Abstract – Container security and contraband interdiction in air cargo have become highly relevant topics at airports all over the world. The European Union (EU) requires detailed measures for standards in the field of aviation security that also cover training and certification of security personnel. In Switzerland, the same standards are being enacted by the Federal Office of Civil Aviation (FOCA). The training for security personnel is rather widespread and covers topics as for example legal requirements, the history of terrorists' acts and current threats, the ability to identify prohibited articles, proficiency in emergency response procedures, and many more. To meet these regulations on security training as economically as possible, this paper suggests using a blended learning instructional design that is based on Gerson’s E-CLASS method and the four step cognitive method by Murphy et al. In order to assess the security training's impact and efficiency, Kirkpatrick's four step evaluation model is being suggested.

Index Terms — airport security, web-based training, blended learning, training evaluation.

I. INTRODUCTION

Aviation is one of the key industries on a worldwide scale. The transportation of goods and passengers by means of airways is a major facilitator of the global economy. Because of its economic importance and the huge public interest in incidents involving aircraft, aviation is an attractive target for unlawful interferences based on a range of motives.

To protect human beings, goods, and infrastructure, various organizations connected with aviation have to implement extensive security measures. However, high quality security measures require high quality training of human operators. Despite the high evolution of modern technology, in the end it is still the human operators who need to assess a potentially dangerous situation and react accordingly.

High quality training programs are about meeting required learning objectives in the most efficient way possible. However, the most efficient training can only be designed if the advantages of several forms of instruction are smartly combined in order to teach every topic by means of the most suitable teaching method. In this light, it makes perfect sense to use a blended learning approach [1] to draw from the strengths of both computer based training (CBT) and the traditional training in face to face settings (FTF). The field of aviation security is highly regulated by the European Union (EU) [2]. The Federal Office of Civil Aviation (FOCA) [3] in Switzerland enacts the same regulations as the EU does and nations all over the world provide similar regulations to their aviation industries. Every terror event adds up to increasingly tighter regulations as for example in the field of air cargo with the recent Yemen based parcel bomb plot [4]. Due to these regulations high demands in training program quality are established by governments while airlines, airports and security operators are pressed to save money. It therefore has to be shown if fresh innovations in the field of security training programs allow meeting those high demands as well as being as efficient as possible.

In this context, a systematic evaluation of training programs is the cornerstone to the answer of whether those programs actually meet the requirements in quality or not. Research shows, however, that evaluations in modern organizations hardly go beyond the measurement of the trainees’ satisfaction with the training [5]. Therefore it is not only crucial to design new types of training but also to use the proper methods to evaluate their efficiency. For the purpose of evaluation, Kirkpatrick & Kirkpatrick’s [6] four step method is being suggested as it provides a thorough analysis from trainees’ reactions to the training to the economic benefits a company hopefully gains. A meaningful evaluation of security training can only be achieved if it equally covers all four steps as laid out by Kirkpatrick & Kirkpatrick.
II. METHOD

Since blended learning always includes a CBT part and a FTF part by definition, one first needs to define what teaching methods are supposed to be used in each part.

A. Web based training

For the CBT part, it is being suggested to use Gerson’s E-CLASS model [7]. Gerson published his ideas on the E-CLASS model in a time when the booming internet drove enthusiasts to believe that any kind of web based training (WBT) is better compared to traditional training. However, faculty members were soon confronted with the question of how to design online learning modules in order to see students benefit from them. Here the E-CLASS model provides a structure for CBT/WBT learning modules geared towards a high recollection performance of the learning content. Therefore every lesson in a blended learning WBT is supposedly built according to the following steps:

TABLE I

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
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</thead>
<tbody>
<tr>
<td>Explain</td>
<td>Used to motivate the trainees by explaining the lesson’s purpose and connected benefits.</td>
</tr>
<tr>
<td>Clarify</td>
<td>The main part where theory and the learning content in general is being presented.</td>
</tr>
<tr>
<td>Look</td>
<td>In this part, one or several examples are being presented to illustrate and throw more light on what was previously discussed in theory.</td>
</tr>
<tr>
<td>Act &amp; Share</td>
<td>In this part, trainees are supposed to act and work with the learning content, for example by solving problems, write summaries, give presentations, engage in groups discussions, etc.</td>
</tr>
<tr>
<td>Self-Evaluate</td>
<td>In the self-evaluate part, trainees solve test questions autonomously to verify whether they have reached the lesson’s learning objectives or not.</td>
</tr>
<tr>
<td>Summary</td>
<td>The summary provides a “take home message”, in other words the most important parts of the lesson condensed into a couple short sentences to be more easily remembered.</td>
</tr>
</tbody>
</table>

It is totally possible to have trainees perform all six steps of an E-CLASS lesson inside a WBT. For example, web conferencing tools can be used for trainees to remotely discuss a topic during the Act & Share part. However, the Act & Share part is very inviting for FTF and therefore turning the WBT into a blended learning training.

B. Face to face training

For the delivery of the FTF part of the security training program (located in the act & share part of the E-CLASS structure) the four steps cognitive method by Murphy et al. [8] is being suggested. The four step cognitive model uses a series of simple repetitions to boost trainees’ learning performance. The initial observance of the task to be learnt helps the trainee to memorize order and details for every step of the task, whereas the trainee’s final performance of the task allows the instructor whether targeted level of performance has been reached by the trainee or not:

TABLE II

<table>
<thead>
<tr>
<th>Step</th>
<th>Instructor and trainee behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The instructor silently performs the task. The trainee silently observes.</td>
</tr>
<tr>
<td>2</td>
<td>The instructor performs the task and continuously provides comments. The trainee silently observes.</td>
</tr>
<tr>
<td>3</td>
<td>The instructor silently performs the task. The trainee continuously provides comments.</td>
</tr>
<tr>
<td>4</td>
<td>The trainee performs the task and continuously provides comments. The instructor corrects the trainee where needed.</td>
</tr>
</tbody>
</table>

Results by Murphy et al. show that the four step cognitive model leads to shorter instruction times despite the innate repetitions and students show better final performance. Murphy tested the four step cognitive model in a field experiment where medical students had to learn a surgical procedure. In comparison to the control group, the medical students taught with the four step cognitive model were rated to perform the surgical task better and faster and took less time to learn it.

C. Evaluation

As explained in the introduction, a thorough training evaluation is needed in order to understand the training’s benefits or lack thereof. Kirkpatrick & Kirkpatrick [6], [9]; describe a list of four simple yet thorough evaluation steps to determine the benefits of a training program:

TABLE III

<table>
<thead>
<tr>
<th>Step</th>
<th>Focus</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reaction</td>
<td>This step deals with how favorable students reacted to the training, how they liked it, whether they found it useful or not, etc. This information is typically being collected using questionnaires.</td>
</tr>
<tr>
<td>2</td>
<td>Learning</td>
<td>This step tests how much the students retained of the learning content. Usually they have to perform some sort of final exam.</td>
</tr>
<tr>
<td>3</td>
<td>Behavior</td>
<td>This step deals whether the newly acquired learning content is being transferred into the daily work routine or not. Work analysis, a method in work psychology, is the typical tool for this step.</td>
</tr>
<tr>
<td>4</td>
<td>Results</td>
<td>This step is concerned with the training program’s economic benefits for a company. The challenge in this step is to find key performance indicators (KPI) that validly reflect the former students’ performance.</td>
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</table>

Steps 1 and 2 are especially suitable for WBT as modern learning management system (LMS) server software often includes test taking (step 2) and questionnaire tools (step 1). In cases where trainees’ performances cannot be adequately tested with a web based theory test, results in step 4 in Murphy’s four steps cognitive model may directly feed into step 2 of Kirkpatrick’s evaluation method.
III. SUMMARY AND CONCLUSIONS

In this paper it has been shown how a set of previously unrelated training methods and concepts can be combined to create high value security training programs at efficient costs. The combination of well-structured WBT together with FTF training lead by an instructor during Act & Share parts allow to systematically take advantage of both WBT and FTF settings.

In the future, this blended learning concept's efficiency needs to be empirically verified and the concept itself refined in a continuous and innovative benchmarking process. Using this strategy it is possible to establish a well-documented best practice on security training that both meets governments' regulations as well as the aviation industry's need of cost effective training.

IV. REFERENCES


V. VITA

Philipp Sury works as a research scientist at the University of Applied Sciences Northwestern Switzerland (FHNW) and the Center for Adaptive Security Research and Applications (www.casra.ch) in Zurich. He is a member of the security research team led by Prof. Dr. Adrian Schwaninger and strives to define a blended learning concept in aviation security based on scientifically proven best practices. He also lectures at the Swiss Federal Institute of Technology in Zurich on human vision and product innovation. Philipp finished his studies in psychology (work psychology and media psychology) at the University of Bern (Switzerland) in 2006 and is currently finishing up his PhD.

Prof. Dr. Adrian Schwaninger lectures at the University of Zurich since 1999 and at the University of Applied Sciences Northwestern Switzerland since 2008. He is the head of the Center for Adaptive Security Research and Applications (www.casra.ch) in Zurich and the head of the Institute Humans in complex Systems (MikS) at the School of Applied Psychology, University of Applied Sciences Northwestern Switzerland (www.fhnw.ch/miks). His areas of expertise are aviation security, human factors, scientifically based software development, applied cognitive psychology, and human-machine interaction. Adrian is a member of the ECAC Training Task Force, the ECAC Technical Task Force, the ICAO Working Group on Training, and he leads the ECAC Technical Task Force TIP Study Group. Adrian is recognized as a leading authority on aviation security. He has more than 70 publications and more than 150 invited presentations. In 1999 he has received the Young Researcher Award in Psychology. In 2003 he has received the ASI International Award of Excellence in Aviation Security: Enhancement of Human Factors.

Jasmin Nef is a master student at the University of Applied Sciences Northwestern Switzerland (FHNW) and works at the Center for Adaptive Security Research and Applications (www.casra.ch) in Zurich. Her most notable scientific projects in the past involved analyses and assessments linked with corporate health services. Today she is responsible for the production and evaluation of scientifically based learning content for web based trainings.