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Basic-SiM Train-The-Trainer: A Model to Prepare Aviation Educators for Simulation Based-First Aid Learning

Muhamad Nur Fariduddin[1], Wee Lei Hum[2*], Lilia Halim[3] and Mohd Johar Jaafar[4]

[1]*Faculty of Education, Universiti Teknologi MARA (UiTM), Level 5 & 7, FSK Building 1 5, 42300 Bandar Puncak Alam, Selangor, Malaysia Selangor Darul Ehsan, Malaysia*

[2]*School of Healthcare Sciences, Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur, Malaysia*

[3]*Department of Methodology & Educational Practice, Faculty of Education, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia*

[4]*Department of Emergency Medicine, Pusat Perubatan Universiti Kebangsaan Malaysia, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia*

Medical emergency on board is a new phenomenon that lack of attention. Despite the presence of cabin crew who is certified to provide medical care to the passenger, failure to acquire the non-technical skills and low level of knowledge and technical skills retention is reported to be major challenges in developing a highly competent cabin crew in providing effective medical care. Having the ability to design simulations, implement it into teaching, and effectively evaluate simulated performance is starting to become a key role for educators in health care. For most educators, a practical knowledge and skills gap resides between the need for simulation learning and proficiencies in designing and utilising simulation. The purpose of this model was to develop a 'trained educators' from the aviation industry with the knowledge and skills to utilise simulation effectively. The steps involve identification, development, and integration with a follow-up assessment. The implementation of the program yielded a significant improvement on the participants' knowledge, t (129) = -6.27, p $<$ .001 together with a total DASH-SV score of 6.32. The barriers, including difficulties encountered executing the model, are discussed combined with the implication for future application. This model is an effective approach for developing a trained educator in first aid for aviation incorporated with simulation learning. The trained educator will then become a pioneer and train another organisation.

Keywords: simulation learning, three step model, first aid, aviation education, cabin crew

I. INTRODUCTION

*corresponding author: weeleihum@ukm.edu.my

The rapid development of the aviation industry in Malaysia today indirectly encourages more

people in Malaysia to choose commercial flights that are increasingly rising to two million compared to years ago. The statistics of airlines activities show that the increasing use of commercial flights around the world along with the addition to ageing population contributes to an increase in cases involving medical emergencies in flight (http://www.transtats.bts.gov). Emergency medical case that occurs in flight is a new phenomenon that lack of attention (Amit & Shauna, 2013). Apart from a compact and small cabin with minimal space to provide medical care as well as a low probability to get help from a medical doctor, nurse or medical assistant are indirectly impacted and caused a variety of complications to passengers (Amit & Shauna, 2013).

The above mentioned problems can be overcome by the presence of crew trained in first aid in ensuring proper treatment is given quickly and accurately. Each crew member on duty must undergone intensive training and certified as first aider. In addition, nearly three-quarters of all emergency cases prevailing are handled alone by the crew and the crew demonstrates competence in carrying out their duties as a first aider (Dowdall, 2007). Based on the guidelines issued by the Federal Aviation Administration (FAA), the Aerospace Medical Association (AsMA) Air Transport Medicine Committee's, and the International Civil Aviation Organization (ICAO), each aircraft should have an emergency medical kit, automated external defibrillators (AED), and crew involved in every flight should be certified in accordance with the syllabus of first aid Basic Life Support (BLS).

However, a study conducted by the Wellington School of Medicine in assessing the understanding and performance of the CPR (Cardio Pulmonary Resuscitation) and AED among the crew who attended the refresher course after a year showed an unsatisfactory result. These include their failure to place proper hand position while performing CPR, usage of AED as well as low level of knowledge and self-confidence.

Low mastery of technical skills and knowledge retention in first aid among crew members have been documented in several previous studies that attributed to several key factors such as teaching and learning techniques that are less effective (Kaye *et al.*, 1991), modular teaching and learning of different uses for each airline academy (Parnell & Larsen, 2007) and short period in the training of the crew to acquire the knowledge of first aid (Mahony *et al.*, 2008).

In addition to knowledge and technical skills, non-technical skills also play an important role in improving the safety of patients (Selvadalis et al., 2012). In medical and health sciences education, professional training conducted by faculty is more focused on technical knowledge and skills and is not geared specifically to non-technical skills such as communication, teamwork, and leadership. However, presently in the medical world, non-technical skills should also be mastered in full view as these skills are the most im-

portant skill that must be practiced in everyday work (Rasmussen *et al.*, 2012).

In developing a quality crew in providing medical care to patients, teaching and learning methods should be extended and no longer focused on the technical knowledge and skills alone, due to the lack of exposure to non-technical skills particularly that contribute significantly to an error in giving emergency treatment to passengers (Pronovost, 2013). In addition, the lack of exposure of the crew in an emergency, short training period, together with time constraints to interact with the facilitator are additional factors leading to less effective exercise in conveying knowledge effectively, and thus have an impact on the quality and crew performance in providing emergency treatment to patients (Dreifuerst, 2009).

The train-the-trainer (TTT) model integrated with simulation-based learning is an instructional method that has been used successfully in health sciences and medical education that benefit the development of clinical skills, knowledge of students, patients and health management (Riley *et al.*, 2003). Apart from it, this learning reduces the risk to patients and improves the performance of medical personnel to enable them to acquire the skills and experience without practicing to a real patient (Donaldson, 2009). The Institute of Medicine (1999) also suggests this learning as one of the innovation in strengthening learning in the health sciences clusters that can improve their skills and thereby reducing the risk of errors on patients. Nursing professionals are also concerned about the importance of this learning method, therefore trainers in this field use this method as a teaching and learning methodology to generate specific clinical skills (Gantt & Webb, 2010).

Having the ability to design simulations, implement it into teaching, and effectively evaluate simulated performance is starting to become a key role for educators in health care. For most educators, a practical knowledge and skills gap resides between the need for simulation learning and proficiencies in designing and utilising simulation. In this article, we share a three-step train-the-trainer model to coach aviation educators to utilise simulation effectively in the perspective of a non-medical community. The steps involve identification, development, and integration with a follow-up assessment. Considering the fact that this model was utilised to coach numerous faculty to assimilate simulation across the curriculum, this could be successfully applied in preparing staff development educators particularly trainer or facilitator to implement simulation into their instruction. In this article, we also discuss potential barriers to success including implication for aviation educators.

II. METHODS

A. The Necessity for Development

The present medical condition demands highly effective methods to prepare cabin crew with the necessary skills required to address passengers with complicated needs in order to deliver excellent outcomes. The stakes today are higher for the trainer in the particular airline academy to cultivate a remarkably skilled cabin crew. Simulation offers a mechanism for the students to practice the application of particular knowledge, skills (technical & non-technical) and behaviours whilst contemplating through possible judgments in a standardised simulated case scenario within a safe learning environment. The trainer can create scenarios together with associated responses to learner actions via low to high fidelity mannequin. This education offers practice to better prepare cabin crew to attend to a complicated patient on board. Therefore, as a trainer, it is crucial that they have the knowledge and necessary skills not just to design simulations but at the same time to implement them effectively in their courses and programmes.

B. Trainer Development in the Application of Simulation: The Train-The-Trainer Model

The train-the-trainer model is an efficient method for improving an educator's knowledge and skill in equally subject material together with delivery. This method has been proved to be highly effective (Center for the Health Professions, 2012; American Association of Colleges of Nursing, 2013 & Jeffries, 2008), then again the method was further improved by the authors by integrating new instruction for the trainer and bringing together with a follow-up assessment. By including follow up assessment with regard to the model, it will enable the trainers to hone a definite range of acquired skills and knowledge, for instance, the ability to perform the complete simulation with debriefing to the respective learner.

C. Basic SiM - Three Step Model

The three step train-the-trainer model was adapted from Lane & Mitchell (2013) and further customised by the authors to accommodate the needs to prepare trainer in the aviation industry for simulation learning. The initial step involved in the process was to determine the aviation educators for the simulation education. These particular educators are going to be accountable for designing and leading the future implementation of simulation programmes and will certainly become the simulation trainers of the current organisation. The following step of the process was development. The educators would receive education and training in the skills and knowledge required to design and execute the simulation learning. The last steps highlighted the integration of educator in the role of a simulation trainer and further integrated with

the follow-up sessions to assure the effective implementation.

Step 1: Identification

Prior to the identification of potential educators, author and team members obtained a written agreement with one of the airline companies in the region of South East Asia for this project. With the help of the respective airline company, the airline academy which is responsible for the training and development of the airline crews has identified several potential trainers from the department of Safety & Emergency under the division of first aid. After a thorough brief, the selected individuals were interested and willing to participate in the training which allows them to enhance their knowledge and skills. With healthcare backgrounds (registered nurse & medical doctor), experienced in teaching and learning with simulation knowledge, such specific qualifications are appropriate to be a candidate for a simulation training.

Step 2: Development

The second step is truly the train-the-trainer step. Once the selected educators with the necessary qualifications and experience are identified successfully, the next step focuses on education and training in the knowledge and skills related to simulation learning which includes learning theory and behavioural skills, designing case scenario, conducting effective simulation learning and debriefing techniques following simulation learning. There are several excellent resources for assisting the educators to learn and develop their pool of knowledge in simulation either through online or workshop courses. Authors adapted the course content for simulation training from Structure & Support Debriefing Instructor Training (American Heart Association) & SimPle Teach (Simulation Practice for Teaching & Learning) which was endorsed by the experts from Pusat Perubatan Universiti Kebangsaan Malaysia (UKM). At this stage, it is important to determine the baseline of the simulation-related knowledge of the selected educators. The current scope of first aid for cabin crew covers the BLS with a role-playing session with different types of case scenario for every refresher courses conducted by the educators. Thus, authors utilised the descriptions and learning objectives for each lesson to determine the suitable courses required to enhance the knowledge and skills in conducting effective simulation learning.

The courses that are helpful for the educators include: (1) introduction to simulation; (2) non-technical skills [identifying, training, assessing safe behaviour]; (3) getting to know your simulator; (4) Basic Scenario Design; (5) Introduction to feedback & debriefing; (6) "Hand-on" Debriefing and (7) Adult Learning Behaviour. A timeline for completing this course was established ranging from several minutes to hours for each session and was conducted in 1-day sessions from 0800 to 1700 hrs which include presentations, discussion and interactive sessions among participants. The whole cost was funded by au-

thors and the team members, however, the facilities were provided by the airline company.

Step 3: Integration

The final step of the model was to integrate their role as simulation educators. At this stage, educators are required to plan the overall simulation activities, implement and evaluate the simulation learning effectively. To assimilate the immersion of this role effectively, several interventions were recommended. The intervention involved a half-day sessions with the cabin crew with the desired outcomes such as (1) identification of suitable educational activities related to BLS scope which involve simulation; (2) designing a case scenario; (3) practical session by implementing the designated simulation activities integrated with several elements (non-technical & technical skills); (4) proper usage of simulation equipment and (5) effective debriefing session following simulation.

After a few redundancies for every session, the instructors ought to be very much prepared to expect their role as simulation educators. To pursue their support to the educational programmes, educators are encouraged to identify resources to implement this simulation for their agency. In order to incorporate the simulation effectively into their teaching approaches, authors suggested follow-up evaluation plan in order to measure the effectiveness of the programme.

Post Training – Evaluation

An assessment plan ought to be formulated to evaluate the outcomes of the train-the-trainer programme. The purpose of this programme was to develop a 'trained educators' from the respective airline company with the knowledge and skills to conduct simulation learning associated with BLS scope to train cabin crews. As such, the overall outcomes of this programme were (1) identification of three first aid trainers to serve as simulation educators; (2) completion of each session in step 2; (3) integration into the simulation educator's role through the intervention in step 3; (4) active implementation of the simulation programme as part of the training for cabin crew.

At the end of the programme, all educators continued to implement the programme as part of the training for cabin crew. The aim of this learning was to teach the simulation learning associated with BLS knowledge and skills using a case scenario to cabin crews who were assumed to have no prior knowledge and experience in simulation learning. The focus of this learning was on BLS knowledge, practical skills and non-technical skills that would be required by these cabin crews in their working environment which include three approaches, to maintain the airways and breathing, to provide effective CPR and to utilise the AED to a victim on board associated with the elements of non-technical skills such as effective communication, teamwork among crew members, decision making and situational awareness.

D. Implementation of the Simulation Program

This phase involved the "trained trainers" to conduct a simulation based-first aid learning over a period of 10 weeks. In this phase, the two trainers were involved and they both worked in pairs to deliver the simulation learning to 10-15 participants per session maintaining a minimum ratio of 1 trainer to 10 participants at all sessions. The participants were experienced cabin crews of the respective airline company.

The trainers carried out the simulation learning with the aid of training mannequins and other supporting safety equipment on board the aircraft, as well as learning materials such as power point presentation and a wall chart. Prior to the session, all baseline data of each participant were collected together with the consent form. Each session was held from 0800 hrs to 1600 hrs, which include a general briefing, assessment, simulation via role playing and a debriefing session. The simulation learning intervention started with a general briefing followed by a pre-assessment on the cabin crews' knowledge on BLS via 30 multiple choice questions (MCQ) lasting for approximately an hour. Next, each participant was grouped together consist of five members assimilating a team in operating a flight and were given placard of a case scenario with roles. They were oriented to the role-playing based on the case scenario which covers the expected learning objective and skills (technical & non-technical) based on the elements written on the wall chart.

The afternoon session covered the role-playing which lasted for 10-15 minutes. In this session, the trainer assisted the role-playing session by providing instructions and prompts on specific actions and expected actions to be taken by the team members. Following the session, the trainer conducted a 30-45 minute of debriefing session to reflect on the participants' action which consists of positive feedback and constructive criticism during the session. Lastly, all participants were required to answer the post assessment test which was similar to the pre assessment test, nevertheless the contents was randomly segregated. Before the session end, all participants were given with the DASH-SV (Debriefing Assessment for Simulation in Healthcare – Student Version) form in order to evaluate the debriefing session conducted (Figure 1).

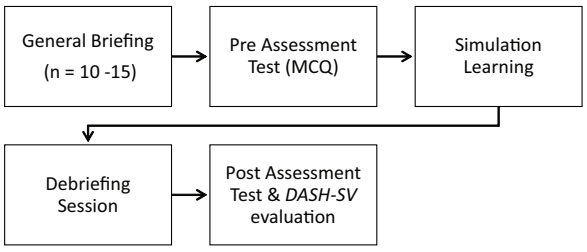

Figure 1. Flowchart showing the summary of the simulation program

E. Ethical Consideration

Before this study was conducted, ethical approval was obtained from the Fac-

ulty of Health Sciences, Universiti Kebangsaan Malaysia (UKM) Research Committee (NN-2017-105) on Ethical Research in humans where the first researcher of this study is affiliated. The institutional review board gave approval, provided this study did not harm participants' right in any way or violate research ethics. As per protocol, our team described the details of the study to the trainers prior to the training session, and for the respondents, a written consent was obtained prior to the commencement of the intervention.

F. Outcomes

The primary outcome was to assess the effectiveness of this model in improving cabin crews' BLS knowledge taught by the 'trained trainers'. Thus, the knowledge was assessed based on the scores in an MCQ test based on the simulated cardiac event. The MCQ was a modified version of the American Heart Association (AHA) Basic Life Support (BLS) and validated by the selected experts in terms of its content and suitability which tested the aspects of airways & breathing, performing CPR and usage of AED. One mark was awarded for every correct answer and no penalty was given for missed or incorrect answers.

G. Statistical Analysis

A power calculation estimated a total of 128 participants were needed to provide more than 80% of power to detect a statistically significant difference between two groups at significance level of 0.05. As such, we aimed to recruit a final total of 150 participants which include an additional of 10-15% of dropout rate to allow for attrition. The estimated sample size calculation was performed using G Power software version 3.12. The mean MCQ test scores were compared using a dependent t-test analysis to look for a change between baseline and post intervention. To analyse the quality of the debriefing techniques conducted, the mean total of DASH-SV scores from the participants were calculated to illustrate the patterns of the data. The statistical analysis was carried out using SPSS Version 22.

III. RESULTS & DISCUSSIONS

The DASH-SV consists of six different elements, which was based on how the instructor conducted the debriefing sessions effectively. Based on Table 1 below, both trained instructors were rated with the mean scores ranging from 6.12 – 6.46 for each elements (consistently effective/very good), with a total mean scores of 6.32 which summarise the overall (very good) impression of effectiveness for the whole elements.

As shown (Table 2), the mean for MCQ scores

Table 1. The mean scores of DASH-SV elements

Elements	N	Mean	SD
1	125	6.12	.666
2	130	6.37	.595
3	129	6.31	.593
4	126	6.28	.631
5	128	6.35	.649
6	130	6.46	.633
Total	123	6.32	.591

was higher (M = 24.28, SD = 2.66) in the post-intervention compared to the baseline (M = 22.34, SD = 3.49). A dependent t – test was conducted to determine the statistically significant differences between the MCQ scores of both groups. Based on the results presented in Table 3, with an alpha level of .05 and MCQ scores from 130 individuals, on average the participants scores 1.93 , 95% CI [-2.50, -1.32], higher following the simulation-based first aid learning intervention than they did during the baseline. The difference is statistically significant, t (129) = -6.27, $p < .001$, with a medium effect size, d = .63. It was concluded that the assumptions of normality and normality of difference scores were not violated after outputting and visually inspected the relevant histograms.

Table 2. Comparison of baseline & post intervention MCQ mean scores

MCQ Scores	N	Mean	SD
Baseline	130	22.34	3.49
Post-Intervention	130	24.28	2.66

The use of simulation based learning has become a widely accepted innovative teaching strategy which promotes active participation and provides experience in applying practical skills as well as developing cognitive skills. With such platforms, the opportunity for the participants to function more independently can be achieved with minimal risk of harm or errors that may occur. Apart from it, the debriefing has been identified as the key element to the effective simulation experience to identify the teachable moments which occurred during the simulation scenario. In this study, the evidence suggested that the participants were able to obtain and successfully retain the cognitive skills following simulation learning by achieving higher scores compared to baseline. Besides that, the responses provided by the participants' DASH-SV scores were found to be beneficial, which indicates the effectiveness on the applications of debriefing techniques to assist the participants on the reflection process following simulation activity. Overall, the above results support the evidence of a successful implementation of the program for the cabin crew. Nevertheless, further assessment, such as technical and non-technical skills, are required before reaching definitive conclusion on the effectiveness of this program entirely.

The main key to success for this type of project is to address several main issues such as obtaining the mutual agreement with the intended airline company. After obtaining the cooperation with the higher management of the op-

Table 3. Mean comparison of MCQ scores

	Mean	SD	95% CI		t	df	Sig (2-tailed)	Effect size (d)
			Lower	Upper				
Post-Baseline differences	-1.93	3.52	-2.50	-1.32	-6.27	129	.000	.63

eration, it is advisable to proceed with the identification of the head of the operation as suggested by the higher management. The operation manager of the respective airline academy is the key position to lead and provide a commitment for this project. Apart from it, the manager may also identify a project leader and provide administrative support as required by the research team. Once all of these resources are in place, the next step is to secure and build up a good rapport with the chosen project leader, which is the head of the selected educator from the respective team of training department in order to execute the train-the-trainer model. Once the selected educators are identified accordingly, the overall plan should be oriented to each of the educators to ensure a mutual understanding is successfully obtained between the research team and the educators.

Another area of concern is to design an appropriate course content together with the time allocated to complete the course which can be challenging. In the authors' experience, encouragement and periodic reminders were effective in engaging all educators to be motivated to complete the course and realised the importance of these training which could benefit them in their future practice. Most airline utilised their self-designed training module based on the guidelines provided by the International Civil Aviation Organization (ICAO), as such our team collaborate with the experts from the respective airline trainer to ensure all contents were fully designed based on the airline modules to prevent any form of deviations which might impact the overall learning outcomes. Further challenges are associated with the scheduling for the educators to complete the training and to conduct the training accordingly. For examples, operations requirement might supersede the training which results in the delay of executing the training. Authors were advised to carefully planned the dates ahead of time, though there were no guaranteed the operations might agree and provided the time and slot to execute the training session. During the follow-up session, authors were unable to obtain the appropriate numbers of crews as requested; however, some adjustment was done by the educators in order to meet the simulation learning objective.

IV. IMPLICATIONS FOR AVIATION EDUCATORS

The three-step train-the-trainer model was successfully used to prepare educators in healthcare industries for simulation instruction and begin to emerge as one of the potential approaches in a non-medical community such as aviation industry. With the current emergencies related to

medical cases on board the aircraft, the cabin crew are now being challenged to provide the best care towards passenger and this has become a crucial area among educators of the respective airline academy to continuously introduce new regulations to ensure each cabin crews are able to obtain the latest and most effective ways to overcome such emergencies. Most educators are constantly introducing new regulations, trends, and topics, and to ensure its effectiveness, simulation provides the best platform which helps to integrate these types of learning methods into their current educational programme.

The use of this three-step model helps to develop an educator specifically in any topic area which can be both effective and efficient. This group of trained educators can then mentor and train another trainer from the same or different association as requested and this will benefit the industry. With the specifically developed train-the-trainer model for aviation industry tailored to the needs of first aid training, authors were hoping to integrate this teaching and learning method as part of the modules used by the cabin crew as a refresher training courses. With the support from the higher management of the respective airline company, this model will be further evaluated by the Department of Civil Aviation (DCA) to ensure its suitability to be applied by all aviation companies across the country. With such accomplishment, the intended airline company has now become a pioneer in the simulation learning and the group of trained educators is now responsible to train other educators from other company.

V. CONCLUSION

In respond to the medical emergencies on board that is growing rapidly over the years, advancement in knowledge and skills preparation is crucial to help cabin crews to transit into a more knowledgeable and highly skilled life saver. The educators' role of the respective training department is challenged by addressing the latest teaching and learning method which helps to provide the educational support to ensure the competencies among cabin crews are met. In response to this, specifically designed programme is required and the educators must have the necessary knowledge and skills not only to design but also to implement the necessary educational programmes. The use of the three-step [Identification-Development-Integration] train-the-trainer model is the key strategy to address this need effectively.

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